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THE NATURAL HISTORY OF BUCKINGHAM PALACE GARDEN, LONDON. PART 2

Supplement to
The London Naturalist number 80: 2001

Edited by Colin W. Plant

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The earthworms (Oligochaetae) of Buckingham Palace Garden

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Abstract

Six species of earthworms are reported from Buckingham Palace Garden from sampling carried out during June 1997. This compares with twelve species recorded in a survey during 1963. The two lists are compared.

Methodology

Bristowe (1964) recorded twelve species of earthworm at Buckingham Palace Garden. During June 1997, earthworms were sampled again, using the standard formalin extraction technique of Edwards & Lofty (1972). This involved diluting 25 ml of 40% formalin in 4.56 litres of water and applying this to 0.36m^2 of soil surface.

Pairs of quadrats were sampled at eight locations throughout the garden. These included areas under trees, in lawns and grass paths, in rough grassy areas, in flowerbeds, amongst *Rhododendron* and in mixed shrub beds. After application of the formalin solution, the quadrats were observed for 15–20 minutes. As worms appeared on the soil surface they were transferred quickly to glass honey jars containing 50% formaldehyde solution. This solution dispatched the worms quickly and preserved them for future identification using Gerard (1964).

Results

Table 1 shows the results of the survey carried out and compares the species recorded in 1997 with those of 1963. The numbers of individuals of each species are given as a percentage (to the nearest whole number where applicable) of the total number of earthworms observed.

Discussion

Eighteen species of earthworms have a wide European and British distribution. The six species of earthworms recorded from Buckingham Palace Garden are fairly typical of the species present in cultivated soil, parks and gardens throughout the British Isles. Although only sixteen quadrats were sampled in total, a surprisingly large number of individuals (298) was recorded, amounting to approximately eighteen individuals per quadrat. The 1963 survey recorded 400 clitellate worms. However, the sampling was done in September of that year, a month when earthworms would have been much more active than in June. Very few earthworms were found in the lawn surrounding the lake, the likely cause being the large amount of wildfowl droppings rich in ammonia, which is extremely detrimental to earthworms.

The most prolific areas were near the rose garden. Here, high numbers of *Lumbricus rubellus* were recorded. This species prefers habitats near large amounts of organic matter and, at the time of sampling, there was an ample covering of manure on the rose beds. *Eisenia foetida*, which was recorded in the 1963 survey, may have been inhabiting the manure on the rose beds, as it is a species which prefers to live in habitats with high concentrations of organic matter such as manure and compost heaps; unfortunately, however, it was not possible to sample within the beds themselves on this occasion.

Other species listed in the earlier survey but not recorded in 1997 include *Eophila icterica*, *Dendrobaena subrubicunda* and *Allolobophora nocturna*. *A. nocturna* is restricted to a few localities in the British Isles and a limited sampling is unlikely to record it. *E. icterica* and *D. subrubicunda* were recorded as single specimens and were almost certainly introduced in soil surrounding imported plants. *Octolasion cyaneum* was the only new species was recorded in 1997. Although not an abundant worm in the British Isles, it usually frequents moist wooded areas. The species was recorded in beds containing *Rhododendron* and other mixed shrubs, a very similar habitat to that on the Rothamsted Estate in Hertfordshire where it is observed frequently.

Comparing the 1997 survey with that of 1963, the population and species composition of the garden appears stable, probably as a result of the seasonal management of the grounds which seems to cause very little, if any, major disturbance. Of the species not found in 1997, an increased sampling in either spring or autumn would probably record most.

TABLE 1. Species of earthworms recorded in 1964 and 1997 as a percentages of the total number of earthworms sampled, (figures are adjusted to nearest whole number).

Species recorded	**Number of each species expressed as a percentage of the total earthworm numbers observed in the year indicated**	
Lumbricidae	**1963**	**1997**
Allolobophora caliginosa (Savigny,1826)	12	34
Allolobophora chlorotica (Savigny,1826)	7	3
Allolobophora longa Ude,1885	12	1
Allolobophora nocturna Evans,1946	1	0
Allolobophora rosea (Savigny,1826)	6	0
Dendrobaena rubida (Savigny,1826)	5	0
Dendrobaena subrubicunda (Eisen,1874)	0	0
Eisenia foetida (Savigny,1826)	1	0
Eophila icterica (Savigny,1826)	1	0
Lumbricus castaneus (Savigny,1826)	1	0
Lumbricus rubellus Hoffmeister,1845	21	27
Lumbricus terrestris Linneus,1758	33	34
Octolasion cyaneum (Savigny,1826)	0	1
Total numbers sampled	**400 (100%)**	**298 (100%)**

Acknowledgements

I wish to thank Mr Mark Lane, Head Gardener at Buckingham Palace, for arranging access to the Garden. My thanks also go to Andrew Coull, a member of the Palace gardening staff, whose enthusiasm for earthworm sampling and his extensive knowledge of the Garden made the time spent very rewarding. Finally, I would like to thank Mr Cliff Brooks, a colleague at IACR-Rothamsted, who transported me and my equipment safely to and from Buckingham Palace. IACR-Rothamsted receives grant-aided support from the Biotechnology and Biological Sciences Research Council of the UK.

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The tardigrade fauna of Buckingham Palace Garden

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Abstract

A total of 123 tardigrades of eleven species were extracted from plant material collected during a single visit to Buckingham Palace Garden in May 1996. One of the species found, *Isohypsibius sattleri* (Richters, 1902), represents a new record for the UK and a second species, *Diphascon (diphascon) bullatum* Murray, 1905, has previously only been recorded from Scotland. Although most of the species present are cosmopolitan in distribution, the diversity of tardigrade species is very high. These results are at variance with other studies of urban tardigrades, which have reported low species diversity.

Introduction

Tardigrades are microscopic, multicellular, invertebrate animals, commonly found in the surface water of mosses, lichens and in soils. Typically in the size range of 50 µm to 500 µm (although some individuals can reach 1.2mm), tardigrades possess four pairs of stumpy legs terminated in claws and have a characteristic 'bear-like' lumbering gait, which has lead to their popular name of 'water-bears'. Occupying their own phylum, Tardigrada, over eight hundred species have been described worldwide. Two aspects of tardigrades have attracted study for a number of years. Firstly, they possess characteristics of both annelids and arthropods and were considered for many years as a link between the two groups. Current taxonomic studies, however, have demonstrated that tardigrades are members of the arthropod clade. Secondly, terrestrial tardigrades have the ability to withstand prolonged periods of drought by a process known as anhydrobiosis. This state of suspended animation also confers extreme resistance to other environmental factors such as heat and radiation. Individuals have been recovered after many years in the anhydrobiotic state and this ability has probably allowed tardigrades (and other invertebrates) to colonise habitats that are exposed to repeated cycles of wetting and drying, such as mosses and lichens.

Despite their widespread occurrence, there have been relatively few systematic studies of the tardigrade fauna of the British Isles. The first published studies were by Murray (1911), who worked on Scottish tardigrades, principally from freshwater environments. Later studies have focused on the tardigrades of moss and lichen (e.g., LeGros 1957), whilst the first systematic study of the British tardigrade fauna, including marine species, was undertaken by Morgan (1976). More intensive studies of a limited locality have been undertaken by Greaves (1989), working on the tardigrade fauna of Surrey, and Greaves and Marley (1994), who surveyed the fauna of Bookham Common in Surrey as part of the ongoing London Natural History Society survey.

The tardigrade fauna of Buckingham Palace Garden was not investigated during the 1960–1963 survey and there have been no previously published records of tardigrades from Greater London.

Materials and Methods

Representative samples of mosses, lichens and decaying organic material were collected from Buckingham Palace Garden during a single visit in May 1996. The author was assisted in collecting by Mr Mark Lane, Head Gardener, who ensured that samples were collected from the range of environments present in the garden. Samples were hydrated in tap water on the same day that they were collected, and tardigrades collected 24 hours later by squeezing the water from each sample and sieving using a 45 µm sieve. Tardigrades were killed and fixed using Ripart and Petit's fixative and mounts for light microscopy, made with either André's mountant or Heinze polyvinyl alcohol and examined by phase contrast and differential interference contrast microscopy. Slides are held in the collection of P. M. Greaves (slide numbers T444 to T567).

An annotated list of Tardigrada recorded in Buckingham Palace Garden

HYPSIBIIDAE

Diphascon (diphascon) bullatum Murray, 1905

Although distributed widely, worldwide, this species has previously only been recorded in the UK from one locality in Scotland. It was found at Buckingham Palace Garden only in moss close to the waterfall at the lake.

Hypsibius dujardini (Doyére, 1840)

A truly cosmopolitan species that was frequently found in moss and lichen in the Garden.

Isohypsibius prosostomus Thulin, 1928

Another widespread species but, in the author's experience, is infrequently reported. In the Garden it was only found in moss growing at the rear of the summerhouse.

Isohypsibius sattleri (Richters, 1902)

This species is considered by some to be a synonym for *I. bakonyiensis* and hence there are mixed records for this species. However, both *I. sattleri* and *I. bakonyiensis* have cosmopolitan distribution, but have not previously been recorded from the UK. This is thus the first record for this country. The species was found in moss at three locations in the Garden.

Isohypsibius schaudinni (Richters, 1904)

Found only at one location, in moss growing on artificial rock.

Ramazzottius oberhaeuseri (Doyére, 1840)

Another cosmopolitan species, which is frequently encountered. It was only found in the Garden in lichen growing on a sandstone bridge.

MACROBIOTIDAE

Macrobiotus echinogenitus Richters, 1903

A common species, which was found in moss at two locations.

Macrobiotus cf. harmsworthi Murray, 1907

This widespread species complex cannot be identified to species level without the presence of eggs, which were not found during collecting. It was encountered in moss in the rock garden.

Macrobiotus cf. hufelandi Biserov, 1991

Another complex that cannot be resolved to species level in the absence of eggs. It is, perhaps, the most frequently encountered tardigrade in collections from moss, but was present in only two samples of moss and one of lichen taken from the Garden.

MILNESIIDAE

Milnesium tardigradum (Doyére, 1840)

This cosmopolitan, carnivorous species was found in lichens, but not moss, in the Garden.

ECHINISCIDAE

Echiniscus testudo (Doyére, 1840)

Two varieties, var. *trifilis* and var. *quadrifilis* (varying in the number of body appendages) were found in a single sample of moss taken from a roof in the Stone Yard.

Discussion

Of the thirty-eight samples taken, sixteen yielded a total of 123 tardigrades. Eleven species were present from seven genera. *Hypsibius dujardini* was the most frequently encountered species, present in eight of the sixteen samples that yielded tardigrades. *Macrobiotus cf. hufelandi* and *cf. echinogenitus* were also frequently encountered. Both Heterotardigrades and *Diphscon* species were rare, with only one species of each present in one sample. Two of the species found represent new records for England; *Diphascon bullatum* has previously only been recorded from Scotland and *Isohypsibius sattleri* has not been recorded from the UK before (McInnes 1994).

There have been relatively few published studies of tardigrades in urban environments (Kinchin 1994). Those studies that have been conducted have generally found few species. Meininger et al (1985), for example, found only four species of tardigrade in urban locations in Cincinnati, Ohio, compared to eight species in neighbouring rural areas. Several reasons for the low species diversity in cities have been postulated, including the 'heat sink' effect of cities, increased convection turbulence, decreased relative humidity, air quality and light penetration. Analysis by Meininger et al (1985) demonstrated high correlation between species diversity with increasing relative humidity and decreasing sulphur dioxide levels.

The results obtained at Buckingham Palace are at variance with other published data. Considering the size of the locality (16 hectares), the tardigrade fauna is highly diversified. By comparison, the county of Surrey, immediately to the south of Greater London, comprises 167,000 hectares and has produced 19 species during an eight-year sampling period (Greaves, 1989; Greaves and Marley, 1994).

Why the diversity of tardigrade species at this site? There has been a dramatic reduction in sulphur dioxide levels in London from a high of 2,830 µg / m^3 in 1952 to a reported range of 0 – 75 µg / m^3 in 1996 (Hawksworth 1999), but the current range is comparable to that of the Ohio study. Two factors are postulated as being important at Buckingham Palace Garden. Firstly, the use of organic mulches may increase local humidity levels such that the rate of drying is slower, allowing tardigrades to encyst; approximately 300 cubic metres of organic matter are applied to the Garden per annum. Secondly, the importation of plants and organic material into the gardens from other locations will lead to the importation of tardigrades at a higher rate than would occur naturally. Thus the rate at which species invade may be a key factor in determining which species ultimately prosper in the urban environment. Do urban environments operate according to the principles of island biogeography (MacArthur and Wilson 1967) for tardigrades? Undoubtedly, more work remains to be undertaken in this field.

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Thanks are due to Mr Mark Lane for his assistance during collecting at the Garden and to Professor Roberto Bertolani of the University of Modena, Italy, for his help in confirming some of the species identifications.

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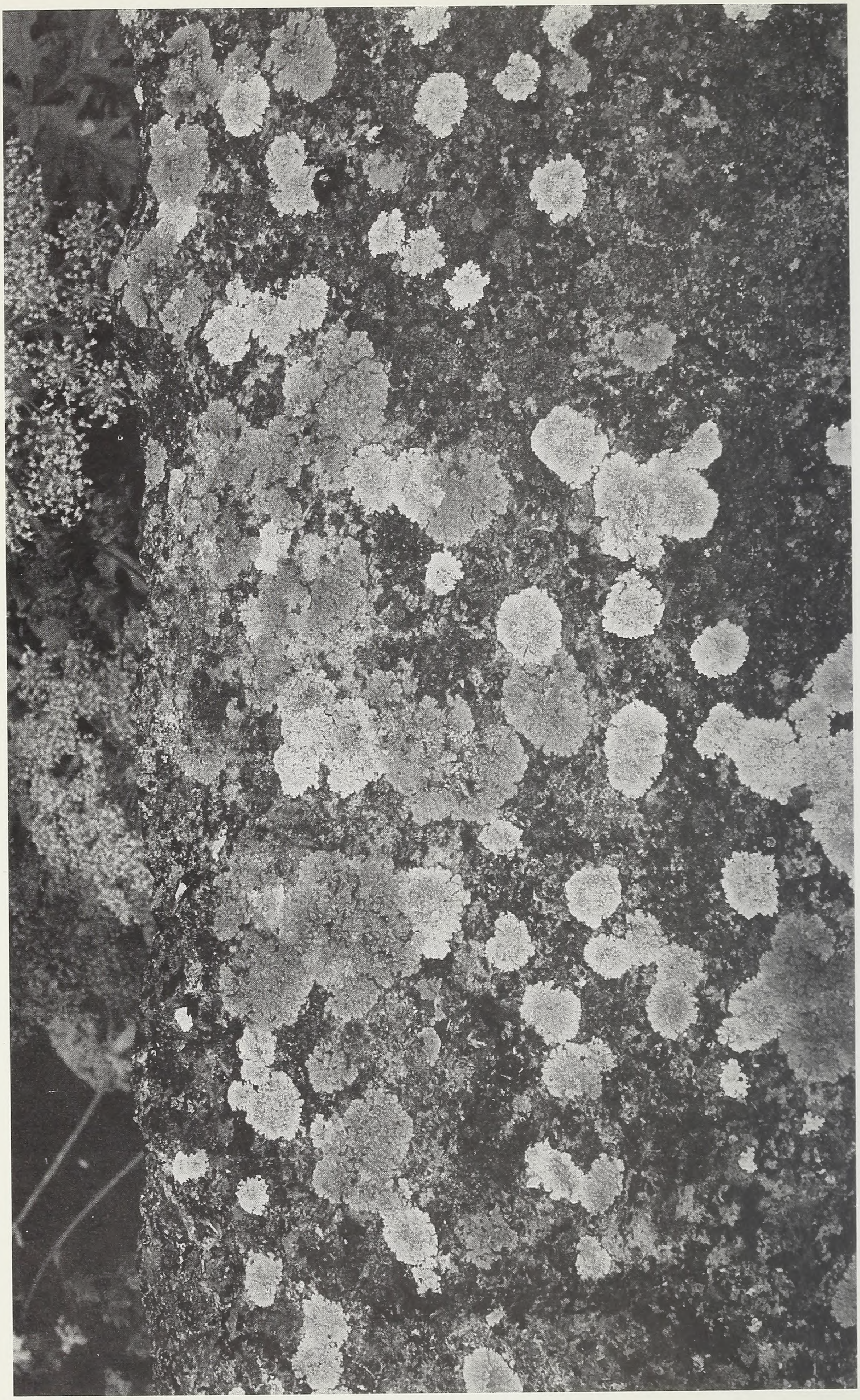

PLATE F. Buckingham Palace Garden, London. Lichens growing on a bridge parapet — a typical tardigrade habitat. *Photographed © by Mark Lane*

Rotifera and Anomopodan Crustacea in Buckingham Palace Garden Lake

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Abstract

Seventeen taxa of Rotifera and twelve of anomopodan Crustacea were recorded from Buckingham Palace Garden Lake during the course of four visits from 1996 to 1998. The lists are compared with those obtained during a survey carried out in 1963 in which sixteen taxa of Rotifera and eighteen of anomopodan Crustacea were reported. Amongst the rotifers, ten previously recorded taxa were not refound during the present study and nine taxa not previously recorded were collected; twenty-five taxa of Rotifera are now known from this water body. Of the anomopodan Crustacea, nine of the previously reported taxa were not refound and three previously unrecorded taxa were noted. A total of twenty-one anomopodan Crustacea are therefore listed from the lake.

Survey methods

Samples were collected from the bank at six widely-spaced sample stations. The positions of these stations are indicated in Figure 1 and each is briefly described in Table 1.

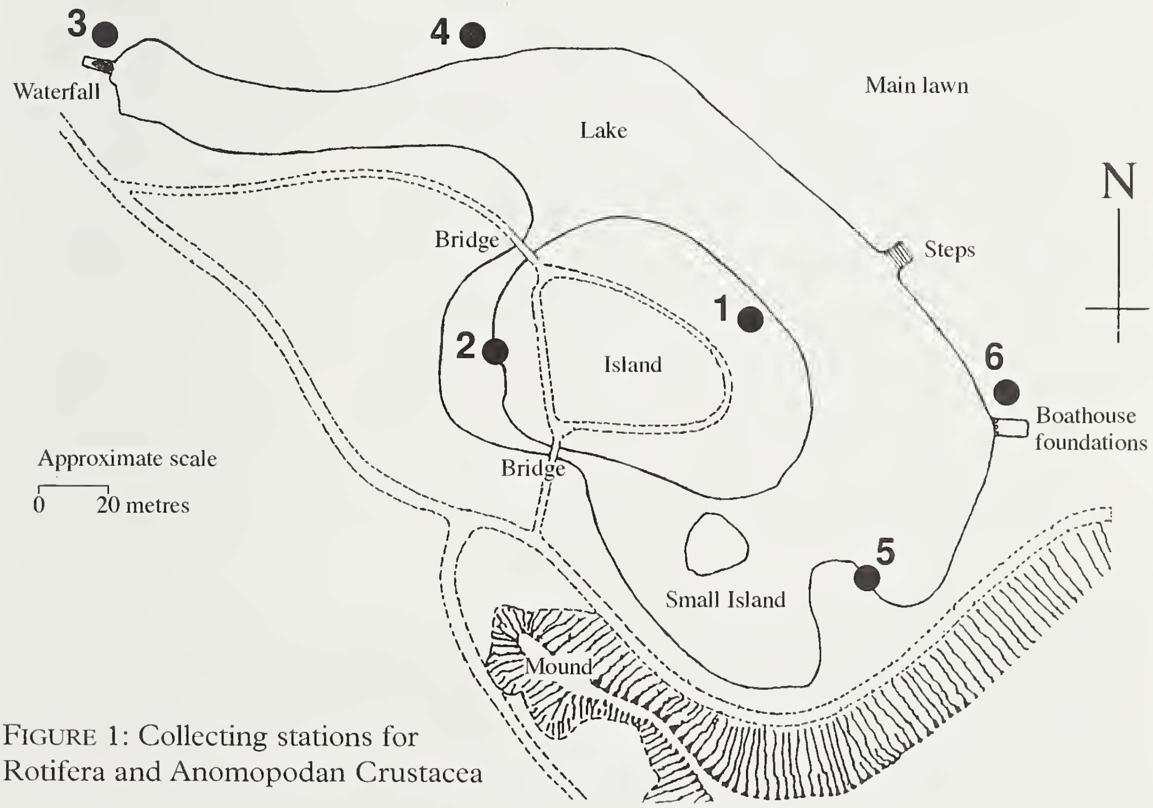

FIGURE 1: Collecting stations for Rotifera and Anomopodan Crustacea

A sixteen-centimetre diameter net of nylon silk, with a mesh aperture of 65µm, attached to a two-metre handle, was swept through the water in wide horizontal arcs and also in vertical sweeps between substrate and water surface. Although care was taken to not foul the net with mud from the lake bottom, it is almost certain that the disturbance caused in the water by the passage of the net caused benthic species of Anomopoda to be swept up and captured. The samples from each station were placed in separate containers without any preservative to permit live examination, so avoiding difficulties resulting from the distortion of specimens. Specimens were held still in a Martin Gravity Compressor (Hollowday 1985), or under a cover-glass supported on petroleum jelly, and examined at magnifications between x30 (for initial searching) and x800 (for identification). For the specific determination of the rotifer *Polyarthra dolichoptera*, the trophi were dissolved out with sodium hypochlorite and examined with oil-immersion at a magnification of x1000. Following initial examination, samples were preserved in 2 percent formalin (Amoros 1984) for further examination at a later date.

Temperatures during each sample period were recorded at a position ten centimetres below the water surface and pH values were also obtained, using a BDH Lovibond colorimetric comparator during 1996, but with a pH meter during the following two years.

TABLE 1. Location and description of Rotifer and Anomopoda sampling stations

Sample station number	Location	Comment
1	Adjacent to Island	Man-made habitat. The bank comprises rocks held in wire-netting. Samples taken amongst rushes.
2	Flamingo Shed	Shaded by trees. The water is fairly stagnant and there are large accumulations of detritus.
3	Waterfall	A small, two-level waterfall circulating the lake water via a pump. Detritus accumulates in the middle area.
4	Opposite intake pump	Near to trees. The wind blows detritus into this area.
5	Table	Calm water, surrounded by trees.
6	Boathouse	Exposed area by a small jetty.

Rotifera

Rotifer taxonomy

For brevity and simplicity, when comparing the total number of taxa in this and an earlier survey by Evans et al (1964), each taxon is referred to as a 'species', even though in the earlier work three taxa are designated 'varieties'. Two of these, which were not refound during the present study, should now be designated as subspecies according to the *International Code of Zoological Nomenclature* (1985: Article 45g). The third 'variety' in the previous report, *Keratella cochlearis* var. *tecta,* appears in the present list where it is treated as a possible morphotype resulting from cyclomorphosis, and is termed f. *tecta*, a practice adopted in the literature for many years. According to Nogrady et al (1993), however, there is now a tendency to treat it as a valid species and for convenience I have included it as a separate entry in the list. Similar remarks apply to *Brachionus quadridentatus cluniorbicularis*, for many years termed a variety, but here listed as a subspecies in accordance with Article 45g of *The Code.*

TABLE 2.
Rotifera and anomopodan Crustacea in Buckingham Palace Garden Lake, 1996 to 1998. Distribution of species by date and sample station

Date of sample →	22.vii.1996						2.xii.1996						10.iii.1997						1.vi.1998					
Sample station number →	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Species recorded ↓																								
ROTIFERA																								
Asplanchna priodonta							●	●											●	●		●	●	
Brachionus angularis			●			●	●	●			●	●	●	●			●							
Brachionus calyciflorus							●	●					●											
Brachionus quadridentatus ssp. cluniorbicularis			●																					
Brachionus urceolaris	●						●						●				●	●						
Cephalodella auriculata	●																							
Keratella cochlearis	●	●		●		●	●	●	●		●		●	●	●	●	●	●	●	●		●	●	●
Keratella cochlearis f. tecta	●	●				●													●	●		●		●
Keratella quadrata	●	●		●	●		●	●	●		●	●	●	●	●	●								
Lecane closterocerca	●						●																	
Polyarthra dolichoptera		●	●		●		●	●	●				●		●	●			●		●	●		●
Pompholyx sulcata	●																			●		●		
Synchaeta pectinata							●	●	●				●											
Testudinella elliptica				●																				
Trichocerca tenuior														●										
unidentified bdelloids				●							●													
ANOMOPODA																								
Daphnia ambigua	●		●									●							●	●	●			●
Daphnia hyalina	●		●								●									●	●	●	●	●
Simocephalus vetulus																						●	●	
Ceriodaphnia dubia			●								●										●			
Bosmina longirostris	●	●	●				●	●				●	●			●	●		●	●	●	●		●
Chydorus sphaericus											●	●							●	●			●	
Alona affinis							●														●			
Alona guttata																●								
Alona quadrangularis															●									
Pleuroxus aduncus												●												
Pleuroxus denticulatus	●																							
Pleuroxus uncinatus												●												

Results and discussion

A complete list of the Rotifera recorded in The Lake is presented below. This list is analysed by date and sample station in Table 2.

As was the case during an earlier study, the present survey was limited, being necessarily confined to four separate visits extended over a three-year period.

In order to obtain a reasonably comprehensive picture of the rotifer fauna of any water body, large or small, it is necessary to sample the habitat at least once each month over a period of several years. The rotifer population is constantly changing, from week to week, in a given aquatic habitat — particularly in the plankton zone. This is not because species are extinguished from the habitat, but more as a result of them passing into a resting phase. These resting phases may last several months or a number of years, during which they are absent from the active component of the fauna and rest on the bottom or in various niches as 'resting' (mictic) eggs. A species may occur in many thousands per litre for a few weeks, only to disappear in less than a week to be replaced immediately by another.

It is almost certain, therefore, that the lists compiled during both of the surveys at Buckingham Palace Garden Lake would have trebled, at least, if sampling had been practical at a greater frequency. However, there is also no doubt that the lists are short for another reason — the apparent absence of submerged macrophytes, noted by the present author and commented upon in an earlier work by Kett and Kirk (1999). Almost all aquatic habitats support at least some submerged plants, and these in turn provide a rich source of weed-haunting rotifers; the almost complete lack of these species from the list is clearly a direct consequence of this lack of waterweed. It is also likely that a more intensive sampling of sediments on the bed of the lake would have generated a longer list of benthic species.

The species encountered during both surveys are typical of the fauna associated with British lowland hard-water eutrophic habitat. The pH values at the sample stations varied from 8.0 to 8.8 during the present survey, except that the value at Station 5 on 1st June 1998 was lower, at 7.5. The range reported in the earlier survey was 7.8 to 8.4. These values all accord closely with those supplied to the Palace by Central Scientific Laboratories of London, Public Analysts, in 1991, 1992 and 1994, during which period they ranged from 7.3 to 8.5.

Many rotifers are tolerant of a range of pH values, whilst others are acidophilic and some occur only in alkaline habitats (Bérzinš and Pejler 1987). Apart from two unidentified bdelloids and *Testudinella elliptica*, whose requirements are not known, and *Brachionus calyciflorus*, which appears to be confined to alkaline waters, all the species in the present list are acid-tolerant, though all are at maximum abundance in alkaline conditions. This also applies to those species recorded in the earlier survey, again with the exception of *B. calyciflorus*, data not being available for the two named species of bdelloids it contained.

Much the same applies to the thermal range of Buckingham Palace rotifers. In the present list only one species, *Pompholyx sulcata*, may be termed a warm stenotherm. It is a well-know "summer" species with a maximum abundance between 12° and 23°C, although Bérzinš and Pejler (1989) quote a range of 6° to 25°C for its total thermal tolerance in Sweden. In Buckingham Palace Garden Lake, it occurred in large number at 19°C (July 1996) and 17°C (June 1998). The remaining species have a sufficiently wide thermal range to warrant being regarded as eurytherms. The same remarks may be applied to the earlier list, apart from *Notholca acuminata* and *N. squamula* (not refound in the current survey), which are regarded as cold stenotherms.

Eleven species in the present list are planktonic in lakes of all sizes, although with the exception of *Pompholyx sulcata* they will sometimes occur in quite small ponds provided that the water is clear of submerged macrophytes. The remaining six, including the two unidentified bdelloids, are littoral and benthic in habit, *Testudinella elliptica* being a commensal on the isopod crustacean *Asellus* (as was one of the bdelloids).

Additional notes on individual species of rotifers

Of special interest was the presence of *Brachionus quadridentatus cluniorbicularis*, a single specimen being found at Station 3 on 22 July 1996. Originally described from the Volga in 1894, it is also known from Europe and was more recently found on Hainan Island off the south coast of China (Koste and Zhuge 1996). There is only one previous British record of this species (Hussey 1985), where it is listed on the basis of a permanent mounted slide in the collection of The natural History Museum. The specimen was collected and mounted by the late E. W. Carlier from Mullard's Pond, Bentley Heath, Warwickshire in 1943.

B. quadridentatus cluniorbicularis is a typical weed-haunting rotifer, a good swimmer but not a true planktont, usually found in small ponds where, like *B. urceolaris*, it tends to attach itself to submerged macrophytes and algae by mucous secretions of the foot glands. It is highly variable in respect of the rear spines of the lorica and some six 'varieties' have been named over the years (Koste 1978), including *cluniorbicularis*. It is possible that they are all morphotypes, but *cluniorbicularis* is considered here as a provisional subspecies.

Testudinella elliptica is one of several commensal rotifers which habitually attach themselves to the aquatic isopod *Asellus* in the vicinity of the pleopods, in which situation it was found in Buckingham Palace Garden Lake. It is rarely found away from the crustacean, although the strong coronal cilia, usually used for current feeding, enable it to swim strongly when detached.

A number of contracted bdelloid rotifers were found during a re-examination of the formalin-preserved samples taken at Station 5 on 2nd December 1996. Although their contracted state did not permit identification, they appeared all to be of the same species, and their comparatively short spurs precluded them from belonging to either of the two species listed in the earlier survey (*Rotaria magna-calcarata* and *R. neptunia*). A single, live bdelloid was dislodged from the *Asellus* upon which *Testudinella elliptica* was found, but this, too, contracted and eluded identification. Its rather short spurs disallowed it being identified with either of the two aforementioned species from the first survey. Interestingly, Donner (1965) mentions the occurrence of *R. magna-calcarata* on *Asellus*, but the earlier report does not mention it being thus found.

Anomopodan Crustacea

Anomopodan taxonomy

The 'waterfleas' were listed in the report of the 1963 survey (Evans et al 1964) under the long-established heading of Cladocera. As pointed out by Fryer (1987a), however, more recent research has shown that the organisms collectively so designated "comprise a heterogeneous assemblage of forms that have no close phyletic affinities". It was, therefore, proposed that the former taxon of Cladocera be split into four Orders — Anomopoda, Ctenopoda, Onychopoda and Haplopoda (Fryer 1987b).

Evans et al (1964) noted that the taxon *Alonella rostrata* (Koch), which was not refound in the present survey, had been place in the genus *Rhynchotalona* prior to 1959, but that Frey (1959) had shown that it belonged in *Alonella*. Subsequently, however, Fryer (1968) has shown that it is generically distinct and should be known as *Disparalona rostrata* (Koch), under which revised combination it is now included in the present report. *Chydorus globosus* Baird, also not refound in the present survey, has also been shown to differ markedly from its supposed congeners, the apparent resemblance being due to convergence (Fryer 1968), and is now listed as *Pseudochydorus globosus* (Baird).

It is usually stated that the sensory seta between the eye and the base of the rostrum in *Bosmina longirostris* is situated halfway between these points. The Palace lake specimens had this seta slightly nearer to the rostrum, a typical example showing it 82µm from the eye and 56µm from the base of the rostrum.

This is a characteristic long-associated with the taxon formerly known as *B. coregoni* Baird, recently shown to be *B. longispina* Leydig (Fryer 1993). The fine setae at the base of, and along the length of, the claw, plus the fact that *B. longispina* is almost entirely confined to acid habitats, leaves no doubt as to the identify of the Palace lake specimens and it would seem that the exact position of the sensory seta between eye and rostrum may be a variable feature.

Frey (1993) proposed the division of the genus *Pleuroxus* in to four subgenera, namely *Picripleuroxus*, *Tylopleuroxus*, *Peracantha* and *Pleuroxus* sensu stricto. Under this scheme, of the three Palace lake taxa *denticulatus* would be allocated to *Picripleuroxus*, *aduncus* to *Tylopleuroxus* and *uncinatus* to *Pleuroxus* sensu stricto. Smirnov (1996) rejects this arrangement, but retains *Picripleuroxus* elevated to generic level and containing *denticulatus*. In the present work, I have followed Smirnov in retaining *aduncus* and *uncinatus* within *Pleuroxus*, but have also retained *denticulatus* in that genus.

Results and discussion

A complete list of the anomopodan Crustacea recorded in The Lake is presented below. This list is analysed by date and sample station in Table 2.

The anomopodan fauna of the lake at Buckingham palace Garden is typical of British lowland, eutrophic habitat, although at least two taxa, *Daphnia hyalina* and *Alona quadrangularis*, are known from upland oligotrophic locations, and at least eight will tolerate varying degrees of acidity. The lack of submerged macrophytes may not influence the benthic and littoral component of the anomopodan fauna to the extent that it affects the Rotifera, largely due to the fact that approximately twelve taxa tend to be bottom-dwellers, thriving in mud and a variety of similar substrates.

Four of the recorded taxa are planktonic (*Daphnia hyalina*, *D. ambigua*, *Ceriodaphnia dubia* and *Bosmina longirostris*).

Daphnia magna, not refound in the present survey, while occurring in open, weed-free waters, tends to favour very shallow farmyard ponds with a very high organic nutrient content and is not normally a component of the plankton of deeper lakes.

Of special interest is the occurrence in the lake of *Daphnia ambigua*, considered to be a North American "import". It was first described by Scourfield (1946) from Kew Gardens, where it had first been noted in 1939. Subsequent to this, it was recognised in North America and Western Europe where Amoros (1984) reports its occurrence as sporadic. Following the Kew record it was found in Regent's Park Lake (Fox 1948). In 1960 it was abundant in The Serpentine in Hyde Park (Evans *et al* 1964), and was first noted in Buckingham Palace Garden Lake in the same year whilst in 1962 it was found in The Long Water at Hampton Court (Evans et al 1964). The latter authors pointed out that, until 1961, the water in the Palace lake was supplied from an artesian well in Duck Island in St James' park via The Serpentine, and opine that *D. ambigua* may have reached the Palace lake via this route.

Daphnia ambigua was found on three of the four visits by the present author, being numerous at stations 1 and 3 on 22nd July 1996, but with only a few specimens found (at station 6) on 2nd December that year. It was completely absent in March 1997 but again numerous at stations 1, 2, 3 and 6 on 1st June 1998. It would appear to lay fertilised (ephippial) eggs in the late autumn/early winter period, reappearing in Spring or early summer. However, Scourfield (1946) reared it in captivity for several months and kept at least one specimen alive from 6th January to 22nd May, during which time, it passed through no less than twenty-four stages. A feature of the development is the gradual reduction in the length of the shell spine, which may be one third as long as the main carapace length in neonates to a mere 'bump' in fully grown adults. Most of the specimens found on 22nd July 1996 were adults almost devoid of a spine, although younger stages with a longer spine were present. It was noticed, however, that at least one specimen, having a spine corresponding to Scourfield's fourth stage, was slightly larger than specimens with a bump corresponding to his twelfth stage and, thus, it would appear that, possibly as a result of varying nutritional levels, later stages may not always be larger than younger ones.

The three new additions to the anomopodan fauna of Buckingham Palace Lake are of ecological interest.

Alona guttata, which occurred at station 4 on 10th March 1997, has a very wide pH tolerance, ranging from 3.3 to 8.55 (Fryer 1993), and is regarded as being a common and widely distributed eurytrophic species in the British Isles.

Alona quadrangularis in company with the closely associated A. affinis (found in both surveys), also exhibits a wide pH range tolerance, between 4·8 and 8·6 (Fryer 1993). Both species tend to favour alkaline, eutrophic, lowland sites and yet, occasionally, occur in acid, oligotrophic uplands. *Alona quadrangularis* was found at station 3 on 10th March 1997.

Pleuroxus denticulatus is rather a rarity in the British Isles and its occurrence in the Palace Lake at station 1 on 22nd July 1996 appears to be only the third for Britain. Originally known only from North America, it was first found in Britain by Scourfield (1907) in a small pond at Exminster, Devon. It was found more recently by Green (1966) at Hampton Court. The three Buckingham palace specimens accord exactly with Scourfield's detailed description and figures. In North America it is reported as common in weedy ponds (Brook 1959) and Amoros (1984) notes that it is found in the periphyton of ponds and lakes. Fryer (personal communication) has not found it in his exhaustive collecting over a period of almost fifty years in Yorkshire and it is probably still confined to eutrophic habitats in the south of England. Although apparently preferring 'weedy' habitat, the station at which it was found in the Palace Lake had a quantity of grasses hanging down into the shallow water and this possibly afforded it the conditions that it prefers.

A list of the Rotifera and Anomopoda recorded in The Lake at Buckingham Palace Garden

The classifications adopted in the list are those found in all modern works, except that Rotifera is elevated to Phylum status, rather than being retained as a Class within Aschelminthes, in accordance with Nogrady et al (1993). Notes on generic and specific nomenclature are given above. Species recorded in both the current and the earlier survey are indicated with an asterisk (*). Species recorded in the earlier survey, but not refound during the present work, are enclosed in parentheses. Species lacking an annotation are found for the first time in the present survey.

ROTIFERA
DIGONONTA
BDELLOIDEA

PHILODINIDAE

(*Rotaria magna-calcarata* (Parsons, 1892))
(*R. neptunia* (Ehrenberg, 1832))

Note: Two additional species of bdelloid were found in the present survey but were unidentifiable due to contraction in the preservative.

MONOGONONTA
COLLOTHECACEA

COLLOTHECIDAE

(*Collotheca ornata cornuta* (Dobie, 1849))

FLOSCULARIACEA

FLOSCULARIIDAE

(*Ptygura crystallina* (Ehrenberg, 1834))

TESTUDINELLIDAE

Testudinella elliptica (Erenberg, 1834)
(*T. patina* (Hermann, 1783))
Pompholyx sulcata Hudson, 1885

PLOIMIDA

ASPLANCHNIDAE

* *Asplanchna priodonta* Gosse, 1850

BRACHIONIDAE

* *Brachionus angularis* Gosse, 1851
* *B. calyciflorus* Pallas, 1766
(*B. leydigii tridentatus* Zernov, 1901)
B. quadridentatus cluniorbicularis Skorikov, 1894
B. urceolaris O. F. Müller, 1773
Keratella cochlearis (Gosse, 1851)
**K. cochlearis* f. *tecta* (Gosse, 1851)
* *K. quadrata* (O. F. Müller, 1786)
(*Notholca acuminata* (Ehrenberg, 1832))
(*N. squamula* (O. F. Müller, 1786))

COLURELLIDAE

(*Colurella uncinata* (O. F. Müller, 1773))

LECANIDAE

Lecane closterocerca (Schmarda, 1859)

NOTOMMATIDAE

Cephalodella auriculata (O. F. Müller, 1773)

PROALIDAE

(*Proales daphnicola* Thompson, 1892)

SYNCHAETIDAE

Synchaeta pectinata Ehrenberg, 1832
* *Polyarthra dolichoptera* Idelson, 1925

TRICHOCERCIDAE

Trichocerca tenuior (Gosse, 1886)

CRUSTACEA

BRANCHIOPODA

ANOMOPODA

DAPHNIDAE

**Daphnia ambigua* Scourfield, 1946
**Daphnia hyalina* Leydig, 1860
(*Daphnia magna* Straus, 1820)
**Ceriodaphnia dubia* Richard, 1894
(*Ceriodaphnia laticaudata* P. E. Müller, 1867)
**Simocephalus vetulus* (O. F. Müller, 1776)

BOSMINIDAE

★*Bosmina longirostris* (O. F. Müller, 1785)

CHYDORIDAE

★*Chydorus sphaericus* (O. F. Müller, 1785)
(*Pseudochydorus globosus* (Baird, 1843))
★*Pleuroxus aduncus* (Jurine, 1820)
Pleuroxus denticulatus Birge, 1879
★*Pleuroxus uncinatus* Baird, 1850
(*Leydigia leydigi* (Schoedler, 1863))
(*Leydigia acanthocercoides* (Fischer, 1854))
(*Disparalona rostrata* (Koch, 1841))
★*Alona affinis* Leydig, 1860
(*Alona rectangula* Sars, 1862)
Alona guttata Sars, 1862
Alona quadrangularis (O. F. Müller, 1785)

MACROTHRICIDAE

(*Ilyocryptus sordidus* (Liévin, 1848))
(*Ilyocryptus agilis* Kurz, 1878)

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Centipedes and millipedes (Myriapoda) in Buckingham Palace Garden

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Summary

A survey of Myriapoda was carried out at Buckingham Palace Garden from 1995 to 1997. In an earlier survey, carried out between 1961 and 1963, only three species were identified. Of these, only *Blaniulus guttulatus* (Bose), was not encountered in the present survey. A combined total of sixteen species of myriapods is recorded: seven centipede and nine millipede species. Most of the recorded centipedes and millipedes are common synanthropic species in England, but *Cryptops anomalans* Newport and *Cylindroiulus vulnerarius* (Berlese) have a much more restricted distribution, although both are previously recorded for the London area.

Introduction and origin of specimens

Most of the material provided for identification in this survey was collected in pitfall traps set to catch a variety of invertebrate species during the survey carried out in Buckingham Palace Garden from 1995 to 1997. Colin Plant set traps to the north and west of the Garden and these are indicated in the map already published (*antea*: 2-3) by solid black dots. Edward Milner set traps in the southern part of the Garden, one on The Island and the others clustered around The Mound; these are also indicated in the same map by the letters A, B, C and D. Other myriapod material was collected from rotten wood and objects on the ground by Colin Plant and by the Head Gardener, Mark Lane.

Results

The list below records a total of sixteen species for the Garden. Of these, fifteen were recorded during the current survey. Notes on general distribution and habitat are derived from Eason (1964), Blower (1985), and Barber & Keay (1988). An earlier survey, carried out from 1961 to 1963, recorded three myriapod species for the Garden, two of them centipedes (J. G. Blower, in Bristowe 1964). There is no indication in that account as to how or where the specimens were collected. The only millipede in that account, *Blaniulus guttulatus*, has not been encountered during the current survey.

An annotated list of centipedes and millipedes (Myriapoda) recorded in Buckingham Palace Garden

The arrangement of taxa follows that of Barber & Keay (1988) for centipedes (Chilopoda) and Blower (1985) for millipedes (Diplopoda). The species found only in the earlier survey are enclosed in round brackets; those found in both surveys are indicated with an asterisk (*). Taxa found for the first time in this survey have neither annotation. Unless otherwise stated the species are common and widespread in England. Records from Colin Plant's pitfall traps are indicated by the initials "CWP" and are listed by their alphanumeric grid reference on the map (*loc. cit.*). Records from Edward Milner's pitfall traps are indicated by the initials "JEM".

MYRIAPODA

CHILOPODA

HIMANTARIIDAE

Haplophilus subterraneus (Shaw, 1789)

Rotten oak stump 16.iv.1997; under rubbish on hard standings 17.iv.1997. Very common in woodland and frequent in grassland and suburban gardens.

SCHENDYLIDAE

Schendyla nemorensis (Koch, 1837)

Pitfalls: JEM, 28.ii.1997. A species frequently found above ground, especially in bracket fungi.

GEOPHILIDAE

* *Necrophlaeophagus flavus* (De Geer, 1778)

Pitfalls JEM: 4.v.1996; under pots etc. iv.1997; under wood on soil and under rubbish on hard standings 17.iv.1997. Generally forages on the soil surface, but frequently found within the soil, its long, narrow, flexible body allowing easy passage through the interstices between the particles.

CRYPTOPSIDAE

Cryptops anomalans Newport, 1844

Pitfalls CWP: C1, 16.iv–12.v.1997; rotten oak stump (approx. C4), 16.iv.1997. Recorded for the British Isles from only fifteen 10-km squares in Barber & Keay (1988), most clustered around London.

Cryptops hortensis Leach, 1814

Pitfalls CWP: E4, H1 iv/v.1997, JEM 25.iv.1997; rotten oak stump (approx. C4), Fletcher's yard under timber 16.iv.1997; under rubbish etc. on hard standings 17.iv.1997. A synanthropic species common in urban gardens.

LITHOBIIDAE

* *Lithobius forficatus* (Linnaeus, 1758)

Pitfalls JEM: 4.v.1996; Pitfalls CWP: E6, E4, G1, H1 16.iv–12.v.1997; Slope 1.viii.1996 (JEM); Fletcher's yard under timber, under sleeper on soil under bushes 16.iv.1997; leaf litter, under rubbish etc, on hard standings 17.iv.1997. Ubiquitous and very common in urban situations.

Lithobius microps Meinert, 1868

Pitfalls CWP: E6 west, E6 east, C1, G1, H1, M3 16.iv–12.v.1997; Fletcher's yard under timber 16.iv.1997; under wood on soil 17.iv.1997. Not notably synanthropic, nevertheless occurs commonly in built up areas.

DIPLOPODA

BLANIULIDAE

(*Blaniulus guttulatus* (Fabricius, 1798))

Recorded in the previous survey by J. G. Blower, but not encountered in the present survey. A widespread species in grassland, arable land and garden soil. It is known to damage seedlings and fleshy roots.

JULIDAE

Cylindroiulus caeruleocinctus (Wood, 1864)

Pitfalls JEM: 4.v.1996 and 25.iv.1997; Pitfalls CWP: E6 west, E6 east, C1, G1, H1, M3 16.iv–12.v.1997; under pots etc. iv.1997 (M.Lane); Fletcher's yard under wood, under sleeper on soil under bushes 16.iv.1997. Can be very damaging to root crops, particularly potatoes.

Cylindroiulus vulnerarius (Berlese, 1888)

Leaf litter 17.iv.1997. Most records in Blower (1985) are for the London area.

Cylindroiulus britannicus (Verhoeff, 1891)

Pitfall JEM: 25.iv.1997; leaf litter 17.iv.1997. Associated primarily with rotten wood and slowly decomposing leaf litter.

Ophyiulus pilosus (Newport, 1842)

Pitfalls JEM: 25.iv.1997; Pitfalls CWP: E6 east 16.iv–12.v.1997. A woodland species often found in gardens, feeding on dead vegetation.

POLYDESMIDAE

Polydesmus angustus Latzel, 1884

Pitfalls CWP: E6 east, G1, H1 16.iv–12.v.1997; rotten oak stump (approx. C4). Ubiquitous and very common in gardens where it may cause damage to roots and strawberry fruit.

Polydesmus inconstans Latzel, 1884

Pitfalls CWP: G1 16.iv–12.v.1997. Commonest in areas of cultivation, but much less common than *P. angustus.*

Polydesmus gallicus Latzel, 1884

Pitfalls CWP: E6 east 16.iv–12.v.1997; under pots etc. iv.1997; Fletcher's yard under timber 16.iv.1997. Widespread in gardens, often in very damp situations.

Brachydesmus superus Latzel, 1884

Pitfalls CWP: H1 16.iv–12.v.1997. A soil millipede, often found quite deep in garden soil.

Discussion

Myriapods are nocturnal invertebrates, hunting (centipedes) or browsing (millipedes) generally on the soil surface. During the day they are usually to be found hiding in damp, dark situations on the ground.

Most of the recorded centipedes and millipedes in Buckingham Palace Garden are common, synanthropic species in England. Although their presence here is no surprise, the absence of other widespread species in urban gardens, in particular the ubiquitous *Tachypodoiulus niger* (Leach), is probably more apparent than real.

However, two species have a more restricted distribution in the British Isles. *Cylindroiulus vulnerarius* and *Cryptops anomalans* are noted in the London area (Barber & Keay 1998; Blower 1985). The presence of *Cylindroiulus britannicus*, on the other hand, seems appropriate!

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PLATE G. Buckingham Palace Garden, London. View of the Kennels area, where pitfall traps were set. There are several rotting tree stumps here.

Photographed © by Mark Lane

Bugs (Hemiptera: Heteroptera and Auchenorhyncha) in Buckingham Palace Garden

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Abstract

Heteroptera and Auchenorhyncha were collected between 1995 and 1997 from Buckingham Palace Garden. A total of 94 species of Heteroptera and 68 species of Auchenorhyncha were recorded. Additional species recorded in the past, most during survey work in the period 1960 to 1963, bring the totals of recorded species for these groups to 100 and 76 respectively. It is considered likely that a number of further species remain unrecorded, and that the Garden may be home to approximately a quarter of the British fauna of these groups. The structural variety of the Garden and the high number of plant species present in a small area are considered to have facilitated the development of a rich fauna, but there are few resident species that are especially uncommon. One species, the anthocorid bug *Buchananiella continua*, was recorded for the first time as a resident British species during the course of the survey, but is now known to be more widely established in the London area. Three Nationally Scarce Auchenorhyncha were recorded. One, the plant hopper *Asiraca clavicornis*, is relatively common in the London area. The other two, the leafhoppers *Iassus scutellaris* and *Macropsis mendax*, are elm-feeders and their presence is suspected to reflect the historical abundance of elms in the Garden before the ravages of Dutch elm disease.

Introduction

Survey work in Buckingham Palace Garden between 1960 and 1963 (Richards 1964) recorded thirty-four species of Heteroptera and fourteen species of Auchenorhyncha. The Heteroptera were recorded by T. R. E. Southwood, but the report states that they were 'probably not exhaustive and did not fully cover all seasons'. The Auchenorhyncha were mostly collected by O. W. Richards and identified by W. LeQuesne, and the resulting list has very much the appearance of a set of casually accumulated records rather than an attempt at systematic survey. Records of both groups include material captured at mercury-vapour light as well as by active collecting. These records are repeated in this paper, along with the much larger volume of records obtained during survey work in 1995–97.

Survey methods

A single visit was made to the Garden by the author to survey the terrestrial Hemiptera on 21 August 1997. This visit used a small number of active survey methods: sweep-netting of herbaceous vegetation and the lower foliage of trees and bushes; beating of woody vegetation; sieving of leaf litter and compost, and hand searching of significant Hemiptera habitats, especially bare and sparsely vegetated ground, tree trunks and large branches, walls, and known host-plants. The date of survey was chosen to provide the greatest number of records for a single visit. However, a single visit inevitably misses a proportion of the fauna, especially those which are adult early in the year. Additional records, covering all seasons, are available from a Malaise trap operated on The Mound from 20 April 1995 to 18 August 1997, samples from which were sorted and distributed to recorders by C. W. Plant. Aquatic Hemiptera in the lake were sampled, along with other aquatic groups, by C. W. Plant on 20 October 1995. A small number of additional records come from pitfall traps operated by E. Milner in 1995 and 1996, from light traps operated by D. Carter in 1995, and from individual captures and records made by A. Halstead, E. Hollowday, M. Lane, E. Milner and C. W. Plant.

Results

A total of 68 species of Auchenorhyncha was recorded by the present survey, of which seven were also recorded by the earlier survey. With seven species recorded by the earlier survey, and a further species recorded between the two surveys, this brings the total of Auchenorhyncha recorded from the Garden to 76 species. Ninety-four species of Heteroptera were recorded during the present survey, of which 28 were also recorded by the earlier survey. This last figure assumes that an unidentified *Notonecta* nymph recorded by the earlier survey was in fact *N. glauca*, recorded by the recent survey and by far the likeliest species to be found, and that a *Micronecta* recorded during the recent survey is *M. scholtzi*, recorded by the earlier survey and the characteristic species of lowland standing waters. Only six of the species found by the earlier survey were certainly not also found in 1995–97, bringing the total recorded from the Garden to exactly 100. These totals comprise roughly 20% of the total British Auchenorhyncha and 17% of the British Heteroptera.

Discussion

There are almost certainly more species as yet unrecorded from the Garden. There are several for which suitable habitat is apparently present. Many of these are probably, in practice, genuinely absent, because of the limited area of available habitat, its isolation from other populations, and the chance events of colonisation and extinction. A small number, however, can be predicted with more confidence as likely to be established. It is possible, for example, that one or both species of *Leptopterna* (Miridae), a characteristic genus of tall grassland, is present. These are early species which would have been missed by active survey, and though there is no reason why either or both should not have been recorded by the Malaise trap, there is equally no guarantee that they would be so caught, even if present in its immediate vicinity. Plant-hoppers (Delphacidae) may also be rather under-recorded: many members of this characteristic grassland group mature early and are not often caught by Malaise traps. The species of this family that have been captured either have multiple generations through the year or, unusually for the group, mature late and overwinter as adults.

The recorded oak fauna is noticeably incomplete, and especially lacking in early species: several additional species may be expected. Additional species would also be expected from ash and from conifers. Some tree-associated species may well have escaped detection during active survey by being concentrated in the upper canopy. In general, there is little evidence that Hemiptera are strongly stratified within tree canopies: most species seem as likely to occur on lower as on higher branches. However, this can only be the case if there are lower branches. Where there are few or no low branches, either because of shading from other trees or active management, the canopy fauna may easily be under-recorded. On the other hand, this cannot be the explanation for the most conspicuous absentees from the birch fauna: birch was easily sampled and a good representative Heteroptera fauna was recorded, but the two very common leaf-hoppers *Oncopsis flavicollis* and *O. tristis*, almost invariably found on birch even in very urban areas in the south-east, were not found. It is unlikely that both were genuinely absent and, even if they were, it is unlikely that they will long remain so.

Most of the recorded Hemiptera fauna is of fairly mobile or very mobile flying species. Some of these species may form transitory populations, and the Hemiptera fauna is likely to change somewhat from year to year as trees mature, plantings change, and weather varies. Making allowance for such year-on-year changes, and for the likely presence of permanently established species not recorded by either of the surveys, the tentative suggestion can be made that the Hemiptera fauna likely to be supported by Buckingham Palace Garden, either continuously or intermittently, over a period of several years probably includes at least a quarter of the total British fauna of Heteroptera and Auchenorhyncha.

Overall, the recorded fauna is much as might be expected from a predominantly ornamental garden. The wide range of woody species encourage a diverse associated fauna, and the spacing given to trees and shrubs in such circumstances, allowing them to shelter one another while permitting exposure to the sun, further encourages the fauna. The garden is, like many large mature gardens, structurally well suited to those species associated with habitat mosaics and transitions, and many of the more characteristic species of gardens are otherwise most often found at wood edges or in hedgerows. The fauna of herbaceous plants found in gardens tends to be rather more idiosyncratic, composed of a mixture of common polyphagous generalists and a small number of more specialised species able to benefit from one or more of the cultivated plants. The former group dominate in the list obtained from Buckingham Palace Garden, but species especially frequent on cultivated plants include the plant-bug *Campylomma verbasci* and the leafhoppers *Eupteryx florida* and *E. melissae.* The plant-bug *Europiella artemisiae*, though not in general a particularly garden-associated species, is in this case dependent on cultivated plants for its presence on the site.

Structural variety and an artificially high diversity of plant species tend to favour a fauna rich in species, especially phytophagous species, but with a poor representation of rarities, precisely as has been found in Buckingham Palace Garden. The scarcer species of Hemiptera tend to be associated with places which have nutrient-poor, drought-stressed or permanently waterlogged soils, or which have a long historical continuity of habitat and management. Precisely those soil conditions favoured by scarce Hemiptera tend to be avoided or corrected by gardeners, and historical continuity is rarely available and still more rarely practised. The opportunity for continuity is arguably greater in Buckingham Palace Garden than in many gardens, but nonetheless the present layout is not of great age by the standards of semi-natural habitats, and was imposed in the interests of ornamental appeal on an area of previously quite different character (McClintock *et al. antea.* 5–8).

There is a well-developed grassland fauna in Buckingham Palace Garden, which differentiates it from most gardens and from many ornamental parks. This fauna is largely dependent on having areas of tall grass that are infrequently mown, though it should be noted that a few species are found only, or predominantly, in close-mown areas. For those species which prefer such short-turf conditions, it is likely to be precisely the most nutrient-poor and heavily managed areas which hold the greatest potential. The closed, pure-grass sward of a well-managed lawn is of minimal value for Hemiptera, but bald patches, severely drought-stressed areas, and areas with one or more small herbs add to the potential value. The tall grassland fauna, though including a significant number of species, appears largely lacking in any of individual note: the only exception to this is the Nationally Scarce planthopper *Asiraca clavicornis.* It may be that additional uncommon species are present, and it is perhaps likeliest that such species are ground-dwelling or near ground-dwelling. However, there is little in the recorded fauna to suggest the likelihood of significant additional interest.

The fauna associated with the lake is poor in number of recorded species and apparent interest. The aquatic Hemiptera of standing waters in lowland England, away from areas of ancient wetland, tend anyway to be of rather limited value. They can, however, include many more species than have been recorded from the Garden lake. The lack of submerged macrophytes, eutrophication, the turbidity of the water, the organic character of the bed and the large number of waterfowl are probably all significant, and inter-related, factors limiting the range of species found. Additional species might be present if there were more submerged and emergent vegetation. The recorded marginal fauna is also very limited. The often rather narrow marginal fringe, extensive shading by woody vegetation, and the abundance of alien ornamental species all limit the potential of the margins, but nonetheless a rather wider range of species might be hoped for. The limited area of habitat suitable for any given species and the isolation of the site from rich wetland Hemiptera faunas may be important limiting factors.

Though the great majority of the recorded species are common and widely distributed in southern England, a few species are either scarce or otherwise worthy of specific comment. The anthocorid *Buchananiella continua* was recorded for the first time as a resident species in Britain during the course of this survey, and the formal addition of this species to the British list was the subject of a separate paper (Kirby 1999). This species has been spreading in Europe for some time (Péricart 1972) and its addition to the British list is not a matter of great surprise. It seems that it is merely fortuitous that it was first recorded from Buckingham Palace Garden: it happened that this site was the subject of intensive survey at around the time of the bug's arrival. There are unpublished records from other sites in London since the first record from the Garden, but seemingly no records as yet from outside the London area.

Three species of Auchenorhyncha recorded from the Garden are Nationally Scarce (Kirby 1992), defined as occurring in fewer than 100 ten-kilometre squares of the National Grid in Britain. None, however, is greatly surprising as a denizen of the Garden. The planthopper *Asiraca clavicornis*, though decidedly uncommon on a national scale, is relatively frequent in the London area, and occurs in a quite wide range of sites, including, and perhaps especially, those prone to disturbance or recovering from past disturbance. The two leafhoppers *Iassus scutellaris* and *Macropsis mendax* both live on elm, and both have seemingly coped well in the aftermath of Dutch elm disease, thriving on young shrubby regrowth. Both are strongly south-eastern in distribution and, though neither is usually associated with the urban area of London, it is well within their usual range. Neither species obviously requires more than the presence of the foodplant in reasonable quantity and in the absence of dense shade.

The presence of these two scarce elm-feeding species, along with the local *Anthocoris gallarumulmi* and the somewhat less local *Ribautiana ulmi*, mean that elm is arguably the most important of the woody species in the Garden for Hemiptera. Some other woody plants support more species (willows, poplars, birch and oak having particularly large associated faunas), but these are mostly common species, which can occur almost wherever the host tree grows. The importance of elm in the Garden may well reflect the large number of elms present prior to Dutch elm disease (McClintock & Lane *antea*. 45–48), the remaining fauna having survived the death and removal of the mature trees.

A comparison of the species list from the recent survey with that from the earlier survey provides little evidence of change in the fauna over the intervening years. However, in some measure the lack of detectable change results from the obvious incompleteness of the earlier list, and the consequent uncertainty as to what else might have been present, but unrecorded. There must have been some changes: two of the species recorded by the recent survey were not established in Britain in the 1960s, and several others have spread in recent decades and are unlikely to have been established in the Garden at the time of the earlier survey.

An annotated list of bugs (Heteroptera and Auchenorhyncha) recorded in Buckingham Palace Garden

Nomenclature of Auchenorhyncha follows Le Quesne & Payne (1981); that of Heteroptera follows Aukema & Rieger (1995–99). Within each of these major subdivisions, species are grouped into families. Families are placed in alphabetical order, and species in alphabetical order within families. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. A single record made between the two surveys (*Empoasca pteridis*) is treated as belonging to the earlier survey. Taxa recorded in both surveys are indicated with an asterisk. Taxa with neither annotation were found for the first time in the present survey.

HETEROPTERA

ACANTHOSOMATIDAE

Acanthosoma haemorrhoidale (Linnaeus, 1758)

A common shieldbug which feeds on the fruits of rosaceous trees and shrubs, and is usually associated with hawthorn. Several were captured from shrubs during active survey of the Garden in 1997.

Elasmostethus interstinctus (Linnaeus,1758)

A common shieldbug, usually feeding on fruiting birches. It was found commonly on birch in the garden during active survey in 1997.

Elasmucha grisea (Linnaeus, 1758)

A common shieldbug on birch, less often found on alder. It was found commonly on birch in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1996.

ANTHOCORIDAE

(*Acompocoris pygmaeus* (Fallén, 1807))

A common species on conifers, the single individual of this species recorded by the earlier survey was found on oak. This leaves some scope for doubt as to its status in the Garden, but suitable foodplants were and are present, and it may well be a long-term resident.

* *Anthocoris confusus* Reuter,1884

A common bug on shrubs and trees in a wide range of habitats: recorded from the Garden by active survey in 1997, and by both the Malaise trap and light-trapping in 1995. It is probably widely distributed in the Garden but is clearly much less common than *A. nemoralis*, a species of similar ecology and often found with it.

* *Anthocoris gallarumulmi* (De Geer, 1773)

A local bug which feeds on aphids within leaf-galls on elm. It was captured in the Garden by the Malaise trap in 1996. It is almost certainly established, especially as it was also recorded by the earlier survey, and is one of a quite impressive range of elm-feeding species recorded from the Garden during the survey.

Anthocoris nemoralis (Fabricius, 1794)

A very common predacious bug occurring on shrubs and trees: found commonly throughout the Garden on a wide range of woody species during active survey in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997.

* *Anthocoris nemorum* (Linnaeus, 1761)

A very common predacious bug found amongst herbaceous vegetation and on low shrubs in a very wide range of habitats. It was found commonly throughout the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995.

Buchananiella continua (B. White, 1880)

Recorded from Britain as a resident species for the first time during this survey, and formally added to the British list by Kirby (1999). It has been spreading for some time in mainland Europe. It lives amongst accumulations of dry leaf litter in trees and shrubs. Its capture for the first time in Britain in Buckingham Palace Garden was probably fortuitous: it has since been recorded from other localities in the London area, and may well have been established for some time before being recognised. It was captured in the Malaise trap in the Garden in 1995, 1996 and 1997, on dates ranging from 7 May to 21 October, and by light-trapping in 1995. Though there may be many pockets of suitable habitat for this species within the Garden, the only place where breeding can be confidently believed to take place is within the Recycling Centre, where *B. continua* was found, during active survey in 1997, to be quite common amongst loosely stacked branches with attached leaves.

Orius majusculus (Reuter, 1879)

A common predacious bug found on low shrubs and tall herbaceous vegetation in a wide range of habitats. It was captured in small numbers during active survey in 1997, and by the Malaise trap in the same year.

* *Orius niger* (Wolff, 1811)

A small predacious bug, often abundant on low flowery vegetation in full sunshine, and often especially frequent on flowers of mints *Mentha* spp. It was found commonly by lightly sweeping plants in a herbaceous border during active survey in 1997.

Orius vicinus (Ribaut, 1923)

A common predacious bug amongst tall herbaceous vegetation and shrubs in a wide variety of habitats, found fairly commonly throughout the Garden during active survey in 1997, and also captured by the Malaise trap and by light-trapping in 1995.

Temnostethus gracilis (Horváth, 1907)

A common bug which lives on trunks and branches of trees, favouring those in sun or half-shade. It was found in moderate numbers on trees of several species in the Garden during active survey in 1997.

Xylocoris galactinus (Fieber, 1836)

A common species, but confined to artificially warm habitats such as manure and compost heaps. It was found fairly commonly amongst composting vegetation in the Recycling Centre during active survey in 1997.

COREIDAE

Coriomeris denticulatus (Scopoli, 1763)

A ground-dwelling species which feeds on black medick *Medicago lupulina* on dry, well-drained ground, and which is fairly common in the south-east of Britain. It was recorded from the garden only as a Malaise trap capture in 1995. It may be an established species, but no good stands of its foodplant were seen for investigation during active survey in 1997.

CORIXIDAE

* *Callicorixa praeusta* (Fieber, 1848)

A common water boatman in a wide range of still waters, and a very mobile species which can rapidly colonise newly or temporarily suitable habitats: recorded from The Lake by C.W. Plant in 1995.

Cymatia coleoptrata (Fabricius, 1776)

A small and rather local water-boatman, usually found in clear still water with abundant weeds. Its presence in The Lake, where it was captured by C.W. Plant in 1995, is somewhat anomalous: the aquatic bugs are otherwise a rather small assemblage of very common species, and *C. coleoptrata* is not a species to which the lake is obviously suited.

(*Hesperocorixa sahlbergi* (Fieber, 1848))

A common water boatman in still waters with a high organic content, and tolerant of a higher density of weed than most of its family. It was recorded at light in the earlier survey, but was not captured from The Lake. This is a very mobile species, and can be caught in light-traps some distance from water, so may never have been established in the Gardens. On the other hand it may have been established in The Lake, and could still be so, if only locally and in small numbers.

(*Micronecta scholtzi* (Scholtz, 1860))

Recorded as being abundant in the lake at the time of the earlier survey, it was probably still present in the 1990s; a *Micronecta* recorded by E. Hollowby from The Lake probably belonging to this species. It is the characteristic member of the genus in lowland standing waters.

* *Sigara dorsalis* (Leach, 1817)

The commonest of the water boatmen in southern Britain, and one which can live in almost any still or slow-flowing water body which is not grossly polluted. It was captured from The Lake by C.W. Plant in 1995.

Sigara distincta (Fieber, 1848)

A common water boatman of still and very slow water bodies, usually favouring those with fairly deep water. It was captured from The Lake by C.W. Plant in 1995.

Sigara falleni (Fieber, 1848)

A common water boatman, found in still and slow-flowing waters, reaching very high densities in such water bodies where there is an extensive bare, silty bed. It was captured from The Lake by C.W. Plant in 1995.

HYDROMETRIDAE

Hydrometra stagnorum (Linnaeus, 1758)

A very common insect on water margins, walking over the water surface in extreme shallows and over wet ground amongst marginal vegetation. It was captured from The Lake by C.W. Plant in 1995, and also in pitfall traps set near the lake margin by E. Milner in 1996 and 1997.

LYGAEIDAE

Drymus sylvaticus (Fabricius, 1775)

A common ground-dwelling bug found amongst dry leaf litter, often beneath tall herbaceous plants or in partial shade: a few were found amongst loose leaf litter around trees in the Garden during active survey in 1997, and further individuals were captured by the Malaise trap in 1995 and 1997.

Kleidocerys resedae (Panzer, 1797)

A common bug which feeds on birch, especially the developing seeds, and is also found on alder and rhododendron. It was found abundantly on birch in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995 and 1996.

Nysius ericae (Schilling, 1829)

A common bug in dry places with low and usually incomplete vegetation cover. A few were found in particularly dry areas of close-mown grassland in the Garden during active survey in 1997.

Peritrechus geniculatus (Hahn, 1832)

A common bug in southern counties, and characteristic of fairly dense dry grassland. Several were captured by sweeping tall grassland in the Garden in 1997, and it was also recorded from the Malaise trap in 1995.

* *Scolopostethus affinis* (Schilling, 1829)

A ground-dwelling bug sometimes found amongst nettle *Urtica dioica* with its relative *S. thomsoni*, but more often in dry open situations, often with incomplete vegetation cover, such as ruderal habitats, open grassland, and coastal habitats. It was found on the ground in dry grassland in the Garden during active survey in 1997, was captured by the Malaise trap in 1995, 1996 and 1997, and was also taken by a pitfall trap in 1997.

Scolopostethus thomsoni Reuter, 1874

A common ground-dwelling bug, particularly associated with dense beds of nettle *Urtica dioica*, but also found amongst other tall herbaceous vegetation, often in partial shade. A few individuals were captured amongst leaf litter in the shade of bushes in the Garden during active survey in 1997.

Stygnocoris fuligineus (Geoffroy, 1785)

A small ground-dwelling bug found in fairly dry places amongst grassland or ruderal vegetation. A few individuals were found in the Garden in areas of close-mown grass during active survey in 1997.

MICROPHYSIDAE

Loricula elegantula (Bärensprung, 1853)

A small, common predacious bug which lives on the trunks and branches of broadleaved trees. Individuals were found on various trees throughout the Garden during active survey in 1997.

MIRIDAE

Atractotomus parvulus Reuter, 1878

A conifer-feeding bug, usually associated with Scots pine and fairly common in southern Britain. It was recorded in the Garden only by light-trapping in 1995. This species is an efficient nocturnal disperser and is quite frequently captured by light-traps in places well-removed from conifers, and so cannot be regarded as certainly established in the Garden, but its foodplant is present, so a resident population is likely.

* *Blepharidopterus angulatus* (Fallén, 1807)
A common bug found on a variety of trees, but especially frequent on birch. It was captured in small numbers from birch in the garden during active survey in 1997.

(*Blepharidopterus diaphanus* (Kirschbaum, 1855))
Reported from willow by the earlier survey, this somewhat local bug is especially frequent on white willow *Salix alba*. It may still be present in the Garden, but the preferred host is not, leaving room for doubt.

Calocoris norvegicus (Gmelin, 1790)
A very common plant bug which is polyphagous on herbaceous plants, including some arable crops. A few individuals were captured from a herbaceous border in the Garden during active survey in 1997.

Campylomma verbasci (Meyer-Dür, 1843)
A small and very local plant bug, polyphagous on tall herbaceous plants, seemingly with a particular predilection for hollyhocks *Alcea rosea* and mulleins *Verbascum* spp. It is most frequent in the London area, and more likely to occur in gardens or on garden escapes on derelict land than in more natural habitats. It was captured in the Garden by C.W. Plant in July 1996, and additional specimens were taken by the Malaise trap in 1995, 1996 and 1997.

Campyloneura virgula (Herrich-Schäffer, 1836)
A common plant bug which lives on various shrubs and the low branches of trees. It appears to be especially frequent on hazel, but can develop large populations on the lower branches of sycamore. It was captured in the Garden only by the Malaise trap in 1995: it is a quite frequent garden species, and it is surprising that it was not found more commonly.

Capsus ater (Linnaeus, 1758)
A common and characteristic grassland species, found in a very wide range of grassy habitats, though absent from short turf. It was captured in the Garden by C.W. Plant in 1996 and by the Malaise trap in 1997. It may be reasonably frequent in the taller grassland, active survey work in 1997 being well past the peak of activity for this relatively early species.

Chlamydatus pullus (Reuter, 1870)
A small, fairly common ground-dwelling bug found amongst low open vegetation, in short grassland or ruderal habitats. It was fairly frequent, if rather local, in close-mown turf in the Garden in August 1997.

Chlamydatus saltitans (Fallén, 1807)
Of similar status and habitats to *C. pullus*, and often found with it. It, too, was found amongst short turf in the Garden, but in smaller numbers than its congener.

Compsidolon salicellum (Herrich-Schäffer, 1841)
A fairly common bug found on bramble, often in at least moderate shade, and one of the few bramble-associated species to occur on thin straggling bramble in dense woodland shade. A small number of *C. salicellum* was found on bramble in light tree shade in the Garden during active survey in 1997.

* *Deraeocoris lutescens* (Schilling, 1837)
A common plant bug found on a wide range of broadleaved trees and shrubs. It was found commonly throughout the garden during active survey in 1997, and additional individuals were caught C.W. Plant in 1997, and by the Malaise trap in 1995 and 1997.

Deraeocoris ruber (Linnaeus, 1758)
A common bug in southern counties, found amongst tall herbaceous vegetation, especially at vegetation transitions such as hedgerows and wood margins. It is often a common species in gardens. It was found in moderate numbers and widespread across the Garden during active survey in 1997.

* *Dicyphus errans* (Wolff, 1804)
A common bug, polyphagous on plants with secretory hairs. Several were captured by lightly sweeping a herbaceous border in the Garden during active survey in 1997.

Dicyphus stachydis Sahlberg, 1878
A common bug, usually found on hedge woundwort *Stachys sylvatica*, though with occasional records from other plants. It has been captured only once during the survey, by the Malaise trap in 1996, and though it is not a great wanderer and is likely to be established in the garden, it may well be rather local.

Europiella artemisiae Becker, 1864
A common bug which feeds on *Artemisia* spp. A number was captured from cultivated *Artemisia* in a herbaceous border during active survey in 1997.

* *Heterotoma merioptera* (Scopoli, 1763)
A characteristic and distinctive species of tall herbaceous vegetation, often found with *Deraeocoris ruber* at habitat transitions such as hedges and wood margin and, like that species, often common in gardens. It was found fairly commonly in the Garden during active survey in 1997, and was also caught by C.W. Plant in 1996 and by the Malaise trap in 1995 and 1996.

Liocoris tripustulatus (Fabricius, 1781)
A common plant-bug, usually feeding on nettle *Urtica dioica* but also recorded from several species of garden plant. Several were caught by lightly sweeping a herbaceous border in the garden during active survey in 1997, but the host plant could not be determined.

* *Lygocoris contaminatus* (Fallén, 1807)
A common plant bug, feeding chiefly on birch, though occasionally recorded from other trees. It was found commonly on birch in the Garden during active survey in 1997.

* *Lygocoris pabulinus* (Linnaeus, 1761)
A very common species, and characteristic of habitat mosaics and transitions, the bugs being associated with tall herbaceous vegetation but needing woody stems in which to lay their eggs. It was found in small numbers at scattered locations in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995.

Lygocoris spinolae (Meyer-Dür, 1841)
A common plant bug of tall herbaceous vegetation and low scrub, often frequent on large banks of bramble in late summer. Several were swept from shrubs in the Garden during active survey in 1997.

Lygocoris viridis Fallén, 1807
Lime is the chief foodplant of this common plant-bug, but it also occurs on sycamore. Captured only by the Malaise trap, with single individuals in 1996 and 1997, this species is almost certainly established in the Garden, but the possibility that the records are of wanderers cannot be ruled out.

Lygus rugulipennis Poppius, 1911
A common plant bug, polyphagous on herbaceous plants, including some arable crops, and especially frequent on members of the Chenopodiaceae. Small numbers were captured by sweeping tall grassland during active survey in 1997.

* *Malacocoris chlorizans* (Panzer, 1794)
A common bug found on leaves of shrubs and the low branches of broadleaved trees, especially in sheltered situations. Several were found during active survey of the Garden in 1997, at widely scattered points. Such widespread records are usual for this bug, which tends to occur at fairly low density.

* *Megacoelum infusum* (Herrich-Schäffer, 1837)
A fairly common oak-feeding species, though far from universally found where its host grows and sometimes occurring in rather small numbers. It was captured by the Malaise trap in 1995, but has not otherwise been recorded by the survey.

* *Monalocoris filicis* (Linnaeus, 1758)
A common bug which feeds on a wide range of ferns, including bracken *Pteridium aquilinum*. It was recorded in small numbers by active survey in 1997, and also caught in the Malaise trap in 1995.

Notostira elongata (Geoffroy, 1785)
A very common species of tall grassland: captured in moderate numbers by sweeping areas of taller grass during active survey in 1997.

Orthops campestris (Linnaeus, 1758)
A common plant bug which feeds on a wide range of umbellifers, including such common species as cow parsley *Anthriscus sylvestris* and hogweed *Heracleum sphondylium*, feeding predominantly on the flowers and seed-heads. It was captured by sweeping amongst tall herbaceous vegetation at the margin of grassland during active survey of the Garden in 1997.

(*Orthotylus bilineatus* (Fallén, 1807))
A somewhat local bug, usually found on aspen *Populus tremula*, and only occasionally on other species of poplar. In the earlier survey it was found on young poplars, and was thought to have been introduced as eggs with the trees. This species may now be absent from the Garden.

Orthotylus ericetorum (Fallén, 1807)
A fairly common species of plant-bug, but restricted in distribution by its food-plants, heather *Calluna vulgaris* and heaths *Erica* spp., and therefore largely a species of heathland. It was found in small numbers on cultivated heathers in the Garden during active survey in 1997, and though not the first time that this species has been recorded in such circumstances, there are still rather few records of it from cultivated forms of heather, and it may well be under-recorded in such circumstances.

Orthotylus flavinervis (Kirschbaum, 1856)
A fairly common tree-dwelling bug, most often associated with alder, but not infrequently, and perhaps increasingly, found on sycamore. It was captured in the Garden only by light-trapping in 1995, but it may well be an established species.

Orthotylus flavosparsus (Sahlberg, 1842)
A common plant-bug, feeding on members of the Chenopodiaceae. It was captured in small numbers during active survey of the Garden in 1997, and was seemingly established at the time, but colonies of this highly mobile insect can be transitory.

* *Orthotylus marginalis* Reuter, 1883
A common bug on willows. During the recent survey, it was recorded in the Garden only by the Malaise trap in 1995. It is probably well-established, since a substantial willow fauna has been recorded and it would be unusual if *O. marginalis* were missing from it, especially in view of the record from the earlier survey. It is a relatively early species, and active survey in 1997 may have been too late in the year to record it.

Orthotylus nassatus (Fabricius, 1787)
A common tree-dwelling bug, usually feeding on limes but occasionally recorded from other trees. Several were captured during active survey in 1997.

* *Orthotylus ochrotrichus* Fieber, 1864
A common bug on shrubs of various species, often found at wood margins, hedgerows and other transitional and marginal habitats, and frequently common in well-structured gardens. It was found to be widespread and fairly common in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995.

* *Pantilius tunicatus* (Fabricius, 1781)
A somewhat local large plant-bug, most frequently found on birch and alder, feeding especially on the developing seeds, but also recorded from hazel. It becomes adult rather late in the year, and may be somewhat under-recorded as a consequence. A single nymph was found on birch during active survey in 1997, and a further individual was captured by M. Lane in the same year.

* *Phytocoris dimidiatus* Kirschbaum, 1856
A common tree-dwelling bug, active at night and spending the day on the trunk, branches and twigs. During the recent survey of the Garden, it was captured only by the Malaise trap in 1997. It is likely to be well-established, and the failure to record it during active survey in 1997 is surprising. The earlier survey reported this species as commoner than

P. tiliae, and noted that this was the reverse of the normal situation. The suggestion was made that *P. dimidiatus*, being the darker of the two species, was more effectively camouflaged against smoke-blackened trunks and branches. It is interesting, therefore, that normality appears to have been achieved during the intervening years with their increased pollution control, *P. tiliae* being overwhelmingly the commoner of the two during the recent survey.

Phytocoris longipennis Flor, 1861
A common bug on a range of broad-leaved trees, and, nationally, the most frequently captured of its genus. It was found fairly commonly throughout the Garden and on a wide range of trees during active survey in 1997, and was also caught by the Malaise trap in 1997.

* *Phytocoris tiliae* (Fabricius, 1777)
A common species on broadleaved trees, with similar habits to the preceding two species. It appears to be the commonest tree-dwelling member of the genus in the Garden, being found commonly during active survey in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995.

Phytocoris ulmi (Linnaeus, 1758)
A common bug, found on shrubs rather than trees, and especially associated with hawthorn. It was found in small numbers during active survey of the Garden in 1997, and also captured by the Malaise trap in 1995.

Phytocoris varipes Boheman, 1852
A common and characteristic species of dry grassland, though absent from short turf. It was found commonly by sweeping taller areas of grassland in the Garden in 1997.

* *Pinalitus cervinus* (Herrich-Schäffer, 1841)
A common and variable plant-bug which feeds on a rather diverse range of flowering trees and climbers, particularly important hosts being holly, ivy and lime. It was found in moderate numbers, but as scattered individuals, during active survey in 1997, and was also caught by the Malaise trap in 1995, 1996 and 1997.

Pithanus maerkeli (Herrich-Schäffer, 1838)
A common and characteristic species of dry grassland, found in moderate numbers by sweeping areas of taller grassland in the garden during active survey in 1997.

Plagiognathus arbustorum (Fabricius, 1794)
A very common plant-bug, polyphagous on herbaceous plants, and especially frequent on nettle *Urtica dioica* and amongst tall ruderal vegetation. It also feeds on a range of cultivated plants and is often common in gardens. It was found to be widespread and fairly common in the garden during active survey in 1997: it was also caught by C.W. Plant in 1996, and by the Malaise trap in 1995 and 1996.

Plagiognathus chrysanthemi (Wolff, 1804)
A very common bug of dry open habitats, including ruderal vegetation and dry grassland. It was found commonly by sweeping areas of taller grassland in the Garden during active survey in 1997.

* *Psallus falleni* (Reuter, 1883)
A common bug, feeding on birch: found commonly on its usual host during active survey of the Garden in 1997.

Psallus haematodes (Gmelin, 1790)
A common willow-feeding bug, found commonly on its usual foodplants near The Lake during active survey of the Garden in 1997.

Psallus perrisi (Mulsant & Rey, 1852)
A very common bug on oak. Captured in the Garden only by the Malaise trap in 1995, but probably well-established and, as an early-maturing species, likely to have been missed by active survey in 1997.

(*Psallus salicis* (Kirschbaum, 1856))
A fairly common species on alder, reported as abundant on this tree at the time of the earlier survey, and quite possibly still present in the Garden.

Psallus varians (Herrich-Schäffer, 1841)
A common bug, usually feeding on oak and perhaps confined to this host as a nymph, but wandering to other trees and shrubs as an adult. A few individuals were beaten from shrubs during active survey of the Garden in 1997, but survey was rather late in the year for this species, and would probably have recorded only the last stragglers.

(*Pseudoloxops coccineus* (Meyer-Dür, 1843))
This somewhat local species is found on large fruiting ashes, and was reported as being common on larger ash trees at the time of the earlier survey, when it was also captured at light. It tends to be somewhat under-recorded because a large proportion of the population lives high in the trees, and may still be present in the Garden.

* *Stenodema laevigata* (Linnaeus, 1758)
A common species of tall grassland, though tending to avoid very dry areas and tolerant of some shade. It was captured by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995, but was, surprisingly, not found during active survey in 1997.

Stenotus binotatus (Fabricius, 1794)
A common and characteristic species of tall grassland, found in large numbers by sweeping taller grassland during active survey of the Garden in 1997 and also recorded by C.W. Plant in 1996, and by both the Malaise trap and light trap in 1995.

NABIDAE

Himacerus apterus (Fabricius, 1798)
A common arboreal damsel-bug, found amongst the foliage of a wide range of broadleaved trees and shrubs, especially in sheltered sunny situations. It was beaten in moderate numbers from woody vegetation throughout the Garden during active survey in 1997.

* *Himacerus major* (A. Costa, 1842)
A common ground-dwelling damsel-bug of dry unshaded situations, especially frequent in open dry grassland, ruderal vegetation and coastal habitats. It was found in small numbers in areas of tall dry grassland during active survey of the Garden in 1997, and was also captured by the Malaise trap in 1995.

Himacerus mirmicoides (O. Costa, 1834)
A common ground-dwelling damsel-bug in dry open habitats, especially those with partial vegetation cover, including dry grassland with a closed sward. Several were found in tall dry grassland during active survey of the Garden in 1997, and it was also captured by the Malaise trap in the same year.

Nabis ferus (Linnaeus, 1758)
A common damsel-bug of dry open habitats, including dry grassland, ruderal vegetation and cultivated land. A very mobile species and a rapid coloniser, it is the most characteristic damsel-bug of frequently disturbed land. Several were captured by sweep-netting areas of tall grassland during active survey of the Garden in 1997.

Nabis limbata (Dahlbom, 1851)
A common damsel-bug of densely-vegetated but unshaded places, especially frequent in damp grassland, wetland, and water margins. It was found commonly amongst marginal vegetation by The Lake during active survey of the Garden in 1997.

Nabis rugosus (Linnaeus, 1758)
A common and characteristic damsel-bug of dry grassland, found in grassy places in a wide range of habitats. It was swept commonly from taller grassland during active survey of the Garden in 1997.

NEPIDAE

Nepa cinerea Linnaeus, 1758
A common water bug found amongst dense weed and at the margins of a wide range of still and slow-flowing waters. One was found in the compost heap by a gardener in 1995.

NOTONECTIDAE

Notonecta glauca Linnaeus, 1758
The commonest of the British backswimmers, this bug is found in a wide range of still and slow-flowing waters. It was captured from The Lake by C.W. Plant in 1995. The

earlier survey reported nymphs of *Notonecta* sp. in The Lake: almost certainly these, too, were *N. glauca.*

PENTATOMIDAE

Aelia acuminata (Linnaeus, 1758)

A characteristic species of dry grassland, this somewhat local shieldbug has increased significantly in recent years, and is probably a beneficiary of recent climate change. Tending in the past to be a species of long-established grassland and heath edge, it has both increased in range and spread to a greater extent into secondary habitats. It was found in small numbers by sweeping areas of tall grassland during active survey of the Garden in 1997, and was also captured by the Malaise trap in 1995.

Eysarcoris fabricii (Kirkaldy, 1904)

A common shieldbug which, though somewhat prone to fluctuation in numbers, has shown a gradual increase over the course of the twentieth century. It feeds chiefly on labiates, and is most frequently associated with hedge woundwort *Stachys sylvatica* or black horehound *Ballota nigra.* Several were caught in the Garden during active survey in 1997, and one was also captured by M. Lane in the same year.

Palomena prasina (Linnaeus, 1761)

Formerly a common species in south-western counties but decidedly local further north and east, this shieldbug has increased considerably in frequency in recent years, and has become a common species of hedgerows and, increasingly, of gardens through much of southern England. It is characteristically a species of sheltered habitat transitions and mosaics, such as wood margins and hedgerows, but can also occur in more open situations provided there is shelter from tough-stemmed herbaceous plants or low bramble. It was found in small numbers on shrubs during active survey of the garden in 1997, and was also caught by the Malaise trap in the same year. It is possible that this was the first year of occupancy of the garden by this species: it is certainly likely that it has not been long established there.

Pentatoma rufipes (Linnaeus, 1758)

A common tree-dwelling shieldbug, found on a wide range of broadleaved trees, and occurring both in established woodland and on more isolated trees, including urban street trees. Several were captured during active survey of the garden in 1997, and it was also taken by light-trapping in 1995: it is likely to be well-established and common, but because much of the population is out of reach in the tree canopy and the bug tends to occur at fairly low density, captures made by active survey rarely give a fair impression of its abundance at a site.

Podops inuncta (Fabricius, 1775)

A ground-dwelling shieldbug found in dry grassland and other open-structured and unshaded habitats. It is fairly common, but easily overlooked and rather under-recorded. A single individual was captured from the Garden by E. Milner in 1996.

REDUVIIDAE

Empicoris vagabundus (Linnaeus, 1758)

A long-legged, slow-moving predator found in dry sheltered places such amongst ivy on trees and walls, amongst dense twigs in shrubs, and under cobwebby overhangs on walls and buildings. It is a fairly common species, but often overlooked. It was found in small numbers on the boundary wall of the Garden during active survey in 1997, and may well be more widely established in suitable situations.

SALDIDAE

Chartoscirta cincta (Herrich-Schäffer, 1841)

A common shore-bug found amongst tall wetland vegetation in marshes and, especially, at water margins. It was found in small numbers amongst marginal vegetation by The Lake during active survey in 1997.

Saldula saltatoria (Linnaeus, 1758)

A common shore-bug, found on damp bare mud, especially at water margins but also in small and often temporary patches of habitat created by disturbance in damp places. It was captured by the Malaise trap in 1995 and is almost certainly established at the margin of The Lake but, surprisingly, was not found there during active survey in 1997.

TINGIDAE

Acalypta parvula (Fallén, 1807)

A small moss-feeding lace-bug found commonly in dry unshaded habitats, especially dry grassland. Several were captured during active survey of the Garden in 1997 by sifting moss taken from amongst areas of taller dry grassland.

Tingis ampliata (Herrich-Schäffer, 1838)

A common lace-bug on creeping thistle *Cirsium arvense*: found by searching its host-plant in tall grassland during active survey of the Garden in 1997.

AUCHENORHYNCHA

CERCOPIDAE

Aphrophora alni (Fallén, 1805)

A common species, polyphagous on trees and shrubs, and most frequent at wood margins, hedgerows and habitat mosaics. It was captured in moderate numbers on trees and shrubs throughout the Garden by active survey in 1997, and was also caught by the Malaise trap in 1995.

Neophilaenus lineatus (Linnaeus, 1758)

A very common grassland species, occurring on a wide range of grass species in a wide range of habitats and vegetation structures, but not found in close-mown or close-grazed grassland. It was captured in moderate numbers amongst taller areas of grassland by active survey in 1997, and occasional individuals, probably wanderers, were found away from the grassland. It was also caught by the Malaise trap in 1995, 1996 and 1997.

Philaenus spumarius (Linnaeus, 1758)

A very common species, polyphagous on herbaceous plants, and a frequent species in gardens. It was found to be common throughout the Garden during active survey in 1997, and was captured by the Malaise trap in 1995, 1996 and 1997.

CICADELLIDAE

Agallia consobrina Curtis, 1833

This is a common species, usually found amongst tall herbaceous vegetation, especially tall ruderal vegetation and habitat transitions such as hedges and wood margins. It was captured by active survey in the Garden in 1997, when it was found in small numbers in areas of tall grass and herbs.

Agallia ribauti Ossiannilsson, 1938

A common species in the south-east, found in dry grassland and disturbed ground, especially amongst short or open-structured vegetation. It was captured by active survey in the Garden in 1997: it was found in dry grassland on the mound, and perhaps occurs elsewhere in dry grassland.

(*Aguriahana stellulata* (Burmeister, 1841))

A somewhat local leafhopper, recorded from a number of trees but perhaps most frequently found on ornamental *Prunus* spp. in parks and gardens. It was recorded at light by the earlier survey, and is not certainly known to have been established in the Garden, though it is quite likely that it was. Suitable trees were specifically searched for this species during active survey in 1997, without success. However, it can be a somewhat elusive species, often present in small numbers, and may still be established.

Alebra albostriella (Fallén, 1826)

This is a common species on oak, and occurs even on isolated trees. It was captured by active survey in 1997, and by the Malaise trap in 1995 and 1996.

Alebra wahlbergi (Boheman, 1845)

This is a generally common species, recorded from a number of shrub species, but most consistently found on elm. It was captured by the Malaise trap in 1995 and 1996 and is probably well-established on woody vegetation in the Garden, with elm the most likely host.

* *Allygus mixtus* (Fabricius, 1794)

A common species, adults being found on trees and shrubs, usually where these occur in mosaic with grassland and herbaceous vegetation. The adults are very mobile, and are frequently caught by trapping methods such as Malaise traps. It was recorded commonly on trees by active survey in the Garden in 1997, by the Malaise trap in 1995, 1996 and 1997, and by the light trap in 1995.

Allygus modestus (Scott, 1876)

This common species is similar in ecology to *A. mixtus*, and often occurs with it. In Buckingham Palace Garden, *A. modestus* appears to be significantly the less common of the two. It was found to be widespread in the Garden during active survey in 1997, and was also caught by the Malaise trap in 1995 and 1997, and by light trapping in 1995.

(*Alnetoidea alneti* (Dahlbom, 1850))

A common, polyphagous tree-dwelling leafhopper, recorded from hawthorn by the earlier survey. It is likely still to be present in the Garden, especially amongst woody vegetation near The Lake, but it is surprising that it was not captured either by active survey in 1997 or by the Malaise trap.

Aphrodes albifrons (Linnaeus, 1758)

A common species, typically found in dry grassland but occurring in a wide range of additional habitats provided they are not heavily shaded. It was found fairly commonly in taller grassland by active survey in 1997, and was also caught by the Malaise trap in 1995 and 1997.

Aphrodes makarovi Zakhvatkin, 1948

A very common polyphagous species found in a very wide range of habitats, including arable land and gardens. Though predominantly ground-dwelling, it is quite frequently caught in Malaise and other traps. Small numbers were found at the margin of a herbaceous border in the Garden during active survey in 1997. It is surprising that it was not more frequently and more widely found during the survey, and would be expected to be widespread and common throughout the garden.

Arboridia ribauti (Ossiannilsson, 1937)

A somewhat local oak-feeding species, found both in woodland and on more isolated trees. It was captured by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995, and is almost certainly an established species on oak in the Garden. The records from this survey suggest that it may live relatively high in the trees and be overlooked by active ground-based survey methods.

Arthaldeus pascuellus (Fallén, 1826)

This is a very common grassland species, though intolerant of close-grazed or close-mown grass. It was found commonly in areas of taller grassland by active survey in 1997, and was also captured by C.W. Plant in 1996.

Balclutha punctata (Fabricius, 1775)

A fairly common species, usually found in grassland and amongst herbaceous vegetation in woodland rides, wood margins, and other transitional or mosaic habitats. It was found in moderate numbers by sweeping around trees on The Mound in 1997, and was also caught by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995.

Cicadula persimilis (Edwards, 1920)

This is an unusual member of its genus, in that it can occur in both wetland and dry grassland: other *Cicadula* spp. are exclusively wetland species, feeding on rushes and sedges. *C. persimilis* is probably usually associated with sedges when it occurs in dry grassland, but may not always be so. During the recent survey, it was captured only by the Malaise trap in 1995. It is not known where in the Garden the species originated, but it is probably likelier that it is established here than that the individual recorded was a wanderer.

Cicadula quadrinotata (Fabricius, 1794)

A common species in wetlands and at water margins, associated with rushes and sedges. It was found commonly amongst marginal vegetation by The Lake in 1997.

Deltocephalus pulicaris (Fallén,1806)

A common and characteristic dry grassland species, especially frequent on short grassland and on somewhat acid soils. it was captured by active survey in 1997, moderate numbers being caught by sweeping in dry grassland, both tall and close-mown.

(*Edwardsiana avellanae* (Edwards, 1888))

A common species on hazel, and likely still to be present in the Garden.

* *Edwardsiana crataegi* (Douglas, 1876)

A common hawthorn-feeding species, to be expected wherever the host plant grows in southern England. It was captured by active survey in the Garden in 1997.

* *Edwardsiana hippocastani* (Edwards, 1888)

This is a common shrub- and tree-feeding species, recorded hosts including elm, alder and hazel. In the recent survey, it was captured only by the Malaise trap in 1995. It is probably established in the Garden, but its abundance and hosts are uncertain.

Edwardsiana ishidai (Matsumura, 1932)

A common shrub- and tree-feeding species, associated particularly with elm and hazel. Captured by the Malaise trap in 1997, this species is probably established in the garden, but its abundance and hosts are uncertain.

Edwardsiana lethierryi (Edwards, 1881)

A common species recorded from a wide range of shrubs and trees. It was found abundantly in the Garden in 1997, and on a wide range of trees. Curiously, it was never captured by the Malaise trap, whereas three other species of the genus, which it might be expected would be found by active survey were they present, were captured by the Malaise trap but not by active recording. There is no obvious reason why this situation should arise. It may be that the relative numbers of different species of *Edwardsiana* change dramatically from year to year and generation to generation, and that during active survey in 1997 small numbers of other species were overlooked amongst much more abundant *E. lethierryi*, but the failure of *E. lethierryi* to appear in the Malaise trap is, in that case, less easily explained.

Edwardsiana plebeja (Edwards, 1914)

A common tree-feeding species, recorded hosts including oak, elm, alder and birch. Captured by the Malaise trap in 1996, it is probably established in the Garden, but its abundance and hosts are uncertain.

Edwardsiana rosae (Linnaeus, 1758)

This is a common species, feeding exclusively on species of rose. It was captured by active survey in the Garden in 1997.

Empoasca decipiens Paoli, 1930

This is a very common species found on a wide range of herbaceous vegetation, including arable crops and garden plants. It was found to be fairly common throughout the Garden during active survey in 1997, and was also caught by the Malaise trap in 1995 and 1996.

(*Empoasca pteridis* (Dahlbom, 1850)

A visit was made to the Garden by Dr B. N. K. Davis in August 1982 for the specific purpose of searching for *E. pteridis*, which at that time was known only from the Chelsea Physic Garden. His success in finding the species was reported *in litt.* to the then head gardener, Mr. D. Mitchell. *Empoasca pteridis* is superficially indistinguishable from the extremely common *E. decipiens*, and fine dissection of the males is needed for determination. Though there are still few records of this species from Britain, they are rather widely scattered. It seems likely that *E. pteridis* has a fairly wide distribution, at least in southern and eastern England, but that it is under-recorded because of being so difficult to distinguish from *E. decipiens* which, as well as being extremely common, is likely to occur in the same places. Though a substantial number of *Empoasca* were taken from the Garden during active survey, and more specimens were available from the Malaise trap, all the males of this species-pair examined proved to be *E. decipiens*. It is, however, entirely possible, and perhaps likely, that *E. pteridis* remains established.

Empoasca vitis (Göthe, 1875)
A common species on woody vegetation, especially where it occurs in mosaic with lower herbaceous vegetation or grassland. It was captured by active survey in 1997, and proved fairly frequent on shrubs throughout the Garden. It was also caught by the Malaise trap in 1996 and 1997.

(*Eupteryx atropunctata* (Goeze, 1778))
A somewhat local species of tall herbaceous vegetation, swept from hawthorn during the earlier survey. It could still occur in the Garden, but lack of knowledge of its host plants make it difficult to know the likelihood of this.

Eupteryx aurata (Linnaeus, 1758)
A very common species, associated with tall herbaceous vegetation, especially tall ruderal vegetation but also including herbaceous plants in gardens. It was found to be fairly common and widespread throughout the Garden during active survey in 1997, and was caught by the Malaise trap in 1995 and 1997.

Eupteryx florida Ribaut, 1936
A common species associated with a wide range of labiate plants, often frequent in gardens. It was common in herbaceous beds during active survey in 1997, and was also caught by the Malaise trap in 1995 and 1996, and by light trapping in 1995.

Eupteryx melissae Curtis, 1837
This is a common species associated with a wide range of labiates, and often frequent in gardens. It was captured in herbaceous borders by active survey in 1997, and by the Malaise trap in 1996 and 1997.

Eupteryx urticae (Fabricius, 1803)
This is a common species, but specific to nettle *Urtica dioica*, not a plant usually encouraged in gardens generally and certainly infrequent in Buckingham Palace Garden. It was captured by the Malaise trap in 1995, and is probably established in the Garden on nettle, even if uncommon.

Eurhadina pulchella (Fallén, 1806)
This is a common oak-feeding species, captured by active survey in the garden in 1997.

Euscelis incisus (Kirschbaum, 1858)
This is a very common grass-feeding species, in southern England absent only from the shortest, the wettest and the most shaded grassland. It was captured by active survey in the Garden in 1997, and was common in areas of taller grassland.

* *Fagocyba cruenta* (Herrich-Schäffer, 1838)
This is a common species associated with a wide range of tree species, especially beech. It was captured by active survey in the Garden in 1997, and was swept in small numbers from woody vegetation.

* *Graphocephala fennahi* Young, 1977
A widespread and often common species on *Rhododendron* in southern England. It was found commonly during active survey of the Garden in 1997, and was also recorded by A. Halstead in 1998, and caught by light trapping in 1995.

Hauptidia maroccana (Melichar, 1907)
An introduced species, established outdoors in the south-west, but elsewhere in Britain confined to glasshouses. It was recorded from the Garden by A. Halstead on glasshouse plants in 1998.

Iassus lanio (Linnaeus, 1761)
A common oak-feeding species: captured by the Malaise trap in 1995 and 1997 and by light-trapping in 1995, and probably well-established in the Garden.

Iassus scutellaris (Fieber, 1868)
A Nationally Scarce species, confined to elm, and of strongly south-eastern distribution. A total of seven individuals were captured by the Malaise trap in 1996, six in the period 11.vii – 1.viii, and a further one in the period 10 – 28.xi: it is almost certainly established in the Garden on elm.

Idiocerus confusus Flor, 1861

This is a generally common willow-feeding species, found fairly commonly on willows in the Garden during active survey in 1997.

Idiocerus distinguendus Kirschbaum, 1868

A common poplar-feeding species: though captured during the recent survey only once, by the Malaise trap in 1996, it is probably established in the garden.

(*Idiocerus nitidissimus* (Herrich-Schäffer, 1835)

A common species on poplars, recorded from its usual host by the earlier survey; and quite likely still to be present in the Garden.

Idiocerus herrichi Kirschbaum, 1868

This is a somewhat local species, feeding on willows, especially white willow. It is a south-eastern species, and has been increasing in frequency and range in southern England for some time. It was captured from crack willow by active survey in the Garden in 1997 and was also caught by the Malaise trap in 1995.

Idiocerus populi (Linnaeus, 1761)

A common poplar-specific species, found to be fairly frequent in the Garden during active survey in 1997.

Idiocerus similis Kirschbaum, 1868

A generally common willow-feeding species, captured by active survey of the Garden in 1997, but found only in small numbers.

Idiocerus stigmaticalis Lewis, 1834

A generally common willow-feeding species, found commonly on willows in the Garden by active survey in 1997.

Idiocerus ustulatus (Mulsant & Rey, 1855)

A recent colonist in Britain, feeding on grey and white poplars, and increasing in the south-east. It was captured only once during the survey, by the Malaise trap in 1996, but is quite likely to be established in the Garden.

Idiocerus vitreus (Fabricius, 1803)

A common poplar-feeding leaf-hopper, found fairly commonly by beating lower branches and searching trunks of poplars in the Garden in 1997.

Jassargus distinguendus (Flor, 1861)

A common grassland leaf-hopper, captured by the Malaise trap in 1997 and probably established in the Garden in areas of taller grassland.

Kybos betulicola (Wagner, 1755)

A common leafhopper on birch, found in moderate numbers in the Garden in 1997 by beating the host plant.

(*Kybos populi* (Edwards, 1908))

A fairly common species on poplars, especially grey and white poplars: recorded 'on poplar' by the earlier survey, and quite likely still to be present in the Garden.

Kybos virgator (Ribaut, 1933)

A common willow-feeding species: captured in the Garden by active survey in 1997.

Linnavuoriana decempunctata (Fallén, 1806)

A somewhat local birch-feeder: captured in the Garden by the Malaise trap in 1997, and probably an established species.

Macropsis graminea (Fabricius, 1798)

A somewhat local species, feeding on several types of poplars: recorded from the Garden by the Malaise trap in 1995, and probably an established species.

Macropsis infuscata (J. Sahlberg, 1871)

A somewhat local species which feeds on willows, especially low-growing forms and species: captured by the Malaise trap in 1995 and probably established in the Garden.

Macropsis mendax (Fieber, 1868)

A Nationally Scarce elm-feeding species, confined to south-eastern counties but able to thrive on low re-growth after Dutch elm disease. It was recorded in the Garden by active survey in 1997, when a single individual was beaten from elm.

Macropsis prasina (Boheman, 1852)

A common willow-feeding species, captured in the garden by active survey in 1997, when it was found in moderate numbers on willows near The Lake margin.

Macrosteles laevis (Ribaut, 1927)

A common and characteristic species of managed grassland, captured amongst both tall and, in smaller numbers, mown vegetation in the Garden by active survey in 1997.

Macrosteles viridigriseus (Edwards, 1924)

A common wetland species, often found amongst low vegetation, including rushes, in marshes and at water margins. It was found quite commonly by sweep-netting at the margin of The Lake in 1997.

Mocydia crocea (Herrich-Schäffer, 1836)

A very common species of dry grassland, found in abundance by sweeping areas of taller grassland in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997.

* *Placotettix taeniatifrons* (Kirschbaum, 1868)

An introduced species which feeds on rhododendron. First recorded in Britain in 1951, it has since been recorded from a number of localities in the south-east, but has remained decidedly local and scarce, in contrast to the other rhododendron-feeding leafhopper, *Graphocephala fennahi*. It is, however, a common species in the Garden, readily captured by sweeping and beating rhododendron during active survey in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997.

Psammotettix confinis (Dahlbom, 1850)

A very common dry grassland species, especially characteristic of short swards: found abundantly by sweeping mown grassland in the Garden in 1997, and in smaller numbers in taller grassland.

Ribautiana cruciata (Ribaut, 1931)

A common species, usually associated with bramble but perhaps sometimes feeding on other members of the Rosaceae. It was captured by the Malaise trap in the Garden in 1995 and 1996.

Ribautiana debilis (Douglas, 1876)

A common species, usually feeding on bramble but recorded from other shrubby plants: recorded by active survey in the garden in 1997, when a few were swept from low woody vegetation.

Ribautiana tenerrima (Herrich-Schäffer, 1834)

A chiefly bramble-associated species, probably the commonest of the genus in southern England. It was captured by the Malaise trap in 1995 and 1996.

* *Ribautiana ulmi* (Linnaeus, 1758)

A somewhat local species which feeds on elm, including wych elm and young re-growth after Dutch elm disease. It was captured by the Malaise trap in 1995, 1996 and 1997, by light-trapping in 1995, and is probably well-established in the Garden. It is surprising that this species was not recorded by active survey in 1997.

Thamnotettix dilutior (Kirschbaum, 1868)

A common species, the adults of which live on trees and shrubs, especially at habitat transitions or mosaics, such as woodland margins and rides. It was captured in the Garden by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995, and is probably well-established in areas where trees grow amongst taller grassland.

Zygina angusta Lethierry, 1874

A common species found on a wide range of trees and shrubs, found in small numbers over a wide area of the garden by active survey in 1997, and captured by the Malaise trap in 1996.

Zygina flammigera (Geoffroy in Fourcroy, 1785)

A common species associated with a wide range of trees and shrub, found fairly commonly throughout the Garden during active survey in 1997, and captured by the Malaise trap in 1996 and 1997.

Zyginidia scutellaris (Herrich-Schäffer, 1838)

A very common grassland species, found in all but very short, very wet and very shaded grassland. It was captured commonly in the Garden by sweep-netting tall grassland during active survey in 1997.

DELPHACIDAE

Asiraca clavicornis (Fabricius, 1794)

This is a Nationally Scarce species, largely restricted in Britain to a small area in the south-east, and most frequent in the London area, where it can occur commonly on derelict land. It is typically found in dry, well-drained tussocky grassland. Three individuals were captured by the Malaise trap in 1995, one in the period 7–22.ix and two in the period 22.ix–20.x. It seems likely that this species is established in the Garden, but it may be restricted to the least-managed areas of unshaded grassland.

Dicranotropis hamata (Boheman, 1847)

A common and characteristic dry grassland species, captured commonly by sweep-netting in areas of taller grass in the Garden during active survey in 1997.

Javesella dubia (Kirschbaum, 1868)

A common grass-feeding species, usually found in somewhat damp or shaded situations. It was captured by the Malaise trap in 1996. Though it is quite likely to be established in the Garden, it may well be rather localised.

Javesella pellucida (Fabricius, 1794)

A common grass-feeding species, characteristic of dry grassland but also found in other reasonably dry and unshaded habitats where grasses may form only a minor component of the vegetation. It was found in moderate numbers in taller grassland in the Garden by sweep-netting in 1997.

Stenocranus minutus (Fabricius, 1787)

A common plant hopper amongst tall dry grassland, usually associated with cock's-foot *Dactylis glomerata*. It was captured by the Malaise trap in 1995 and, though probably established in the Garden, may be confined to the least managed areas of grassland.

Acknowledgements

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The psyllids, whiteflies, scales and mealybugs (Hemiptera: Homoptera) of Buckingham Palace Garden

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Abstract

Four visits to The Garden and glasshouse at Buckingham Palace in 1997 and 1998 produced a species list of 13 scale insects, including one new record for Britain, five mealybugs, three psyllids and three whiteflies. The results are compared with an earlier survey conducted in the early 1960s.

Introduction

Psyllids or suckers, whiteflies, mealybugs and scale insects are all sap-feeding insects in the Hemiptera: Homoptera. Some are pests of economic importance because of the feeding damage which can include soiling the foliage with their sticky excrement, known as honeydew (Alford, 1984 & 1991). Sooty moulds often grow on the honeydew and further disfigure the plants.

Methods

The Palace Garden and glasshouse was surveyed on 13 August and 9 September 1997 by the author. Scale insects and mealybugs are relatively immobile insects and they were searched for by examining the foliage and bark of likely host plants. Additional collections were made by Vic Eastop on 24 April 1997 and 9 June 1998 whilst he was searching for aphids. Similar methods were used to record psyllids and whiteflies on the foliage of host plants. Some psyllids were taken in the Malaise trap on The Mound, but most of these remain unidentified due to the lack of a specialist willing to name them. Those that have been recorded in the current survey are those that can be named with confidence through their association with host plants and the distinctive damage they cause. Scales and mealybugs were passed to Dr C. Malumphy of the Central Science Laboratory, York, for confirmation of their identity.

Results and discussion

The whiteflies and psyllids recorded in the earlier survey of Buckingham Palace Garden were collected and identified by V. F. Eastop (1964). The list of psyllids published in 1964 contained seven species, two of which were recorded again in the present survey. The other five species are common, widespread psyllids and, since their food plants still grow in the Palace Garden, they are likely still to occur there. Three additional species, *Floria variegata, Trioza alacris* and *Ctenarytaina eucalypti* have been added to the list in 1997. Three whitefly species were found in the current survey, giving a combined list total of four species.

In the earlier survey scale insects and mealybugs were mostly collected and identified by K. Boratynski in October 1963, with one species added in May 1964. Two other species, *Aspidiotus hederae* and *Coccus hesperidum*, were recorded by V. F. Eastop and identified by D. J. Williams (Boratynski & Eastop, 1964). Nine scale insects and one mealybug were recorded in total. The 1997 survey confirmed the presence of five of these scales and added eight further species. One of these was *Hemiberlesia rapax*, sometimes known as the greedy scale. It had previously been intercepted on imported plant material, but this was the first record of its occurrence in Britain. It was on a container-grown plant of *Myoporum leatum* growing in the Nursery Yard glasshouse. The plant had been obtained from a nursery near Redruth, Cornwall, in 1996. Three additional species of mealybugs were recorded, although two of these are tentative identifications because of difficulties with the material collected.

An annotated list of psyllids, whiteflies, scales and mealybugs recorded in Buckingham Palace Garden

The checklists used are Kloet & Hincks (1964) for the whiteflies (Aleyrodidae) and Hodkinson & White (1979) for the suckers (Psylloidea). The soft scales (Coccidae) are named according to Ben-Dov (1993); the other scales (Diaspididae, Asterolecaniidae and Eriococcidae) and mealybugs (Pseudococcidae) follow Kloet & Hincks (1964) with some updated names suggested by C. Malumphy. Where the names differ from those in Kloet & Hincks, the old names are indicated in square brackets after the current name. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

HEMIPTERA: HOMOPTERA

PSYLLOIDEA

APHALARIDAE

(*Strophingia ericae* (Curtis, 1835))
On heather, *Calluna vulgaris*.

PSYLLIDAE

Floria variegata Löw, 1882
On *Laburnum anagyroides,* collected by V. F. Eastop on 22.iv.1997, and identified by D. Hollis.

(*Psyllopsis fraxini* (L., 1758))
On ash, *Fraxinus* sp.

(*P. fraxinicola* (Förster, 1848))
On ash, *Fraxinus* sp.

* *Psylla buxi* (L., 1758) The Box Sucker.
Causes distinctive cupped leaves at the shoot tips on box, *Buxus sempervirens*. Widespread in the Palace Garden.

P. mali Schmidberger, 1836
Nymphs on apple, *Malus* sp., 22.iv.1997 (V. F. Eastop).

(*P. melanoneura* Förster, 1846)
On hawthorn, *Crataegus* sp.

(*P. peregrina* Förster, 1848)
On hawthorn, *Crataegus* sp.

TRIOZIDAE

Trioza alacris Flor, 1861 The Bay Sucker
Causes distinctive yellow thickening and leaf curling of leaf margins on bay, *Laurus nobilis*. Present in Britain since at least the 1930s, but not recorded in the previous survey (nor was the host plant). Found on bay trees near the Nursery Yard.

Trioza urticae (L., 1758)
On nettles, *Urticae dioica,* on 9.vi.1998, and in the Malaise trap samples for 20.xi–20.xii.1995 and 20.xii.1995–23.ii.1996.

SPONDYLIASPIDAE

Ctenarytaina eucalypti (Maskell, 1895) The Eucalyptus Sucker.
On *Eucalyptus* sp. in the Silver Garden. An Australian insect that reached Britain in the early 1920s. Not found in the earlier survey due to a possible absence of host plants.

ALEYRODOIDEA

ALEYRODIDAE

* *Siphoninus phillyreae* (Haliday, 1834)
On hawthorn, *Crataegus oxyacanthoides*, in the earlier survey. On 9.ix.1997 a small patch of adults and nymphs was found on an ash leaf, *Fraxinus excelsior*, near the Grosvenor Place wall.

Trialeurodes vaporariorum (Westwood, 1856) The Glasshouse Whitefly.
Adults and nymphs, some parasitised by the chalcid wasp *Encarsia formosa*, on many plants in the Nursery Yard glasshouse. Surprisingly not on the 1964 list as this whitefly is a pest in nearly every glasshouse in the land.

* *Aleurotuba jelinekii* (von Frauenfeld, 1867) [= *Aleurotrachelus jelinekii*] The Viburnum Whitefly.
Pupal stage found on *Viburnum tinus*.

(*Aleyrodes lonicerae* Walker, 1852)
On *Glechoma hederacea*.

COCCOIDEA

DIASPIDIDAE

(*Aspidiotus hederae* (Vallot, 1829))
On glasshouse palms. The glasshouses at the Palace are much less extensive than in the 1960s and this may explain the absence of this widespread glasshouse scale, which has a wide range of host plants.

Hemiberlesia rapax (Comstock, 1881)
On *Myoporum leatum* foliage in the glasshouse. New to Britain — see comments in the 'Results and discussion' section.

Carulaspis carueli (Signoret, 1869)
On juniper foliage, *Juniperus* sp. in square J4 [see map on pages 2–3].

* *Chionaspis salicis* (L., 1758)
On the bark of ash, *Fraxinus excelsior*, and willow, *Salix* sp. In the earlier survey it was also recorded on lime, *Tilia* sp.

* *Lepidosaphes ulmi* (L., 1758) The Mussel Scale.
Described as numerous on the bark of crab and fruiting apples, *Malus* spp., hawthorn, *Crataegus monogyna*, and dogwood, *Cornus alba*, in the earlier survey. It had become very scarce in 1997 and required much searching to find a few scales on *Crataegus monogyna*. It is a common pest and its decline is likely to be a temporary one, perhaps brought about by parasitic wasps, which sometimes devastate scale infestations.

ASTEROLECANIIDAE

Asterodiaspis minus (Lindinger, 1912))
On the bark of young oak twigs, *Quercus robur*, 1.v.1964.

* *A. quercicola* (Bouché, 1851).
On *Quercus robur* as above and found again on oak saplings on The Mound on 13.viii.1997.

COCCIDAE

Pulvinaria floccifera (Westwood, 1870) [= *Chloropulvinaria floccifera*] The Camellia Cushion Scale.
Egg sacs and nymphs common on *Camellia japonica*, holly, *Ilex aquifolium* and *Gleditsia aquatica*. The last mentioned is an unusual host plant as it is a deciduous tree and this scale is usually found on various evergreen trees and shrubs.

P. regalis Canard, 1968 The Horse Chestnut Scale.
Now common in southern England, this was an undescribed species new to Britain in 1964 when it was found near Kew Gardens. It probably originated from Japan. Egg sacs and nymphs found on *Acer* spp., including *A. rubra*, 9.vi.1998 (V. F. Eastop), *Aesculus hippocastanea*, *Cornus* sp., *Ptelea trifoliata* and *Tilia* sp.

P. vitis (L., 1758) The Woolly Vine Scale.
A polyphagous scale found as a single egg mass and dead female on a large willow, *Salix* sp., near The Lake.

* *Coccus hesperidum* L., 1758 Soft Scale.
On holly, *Ilex aquifolium* in the earlier survey. On *Myoporum leatum* and *Citrus* plants in the glasshouse on 13.viii.1997. A common pest, mostly on indoor plants.

(*Eulecanium tiliae* (L., 1758))

On hawthorn, *Crataegus monogyna*, found as a single, dead, parasitised female. A widespread species not found in the current survey but easily overlooked as it is often present on its various host plants in low numbers.

Parthenolecanium corni (Bouché, 1844) Brown Scale.

A common pest of many deciduous trees and shrubs. On jasmine, *Jasminum officinale*, on the Royal Mews wall and on ash, *Fraxinus excelsior*, near the Grosvenor Place wall on 9.ix.1997.

P. rufulum (Cockerell, 1903)

An infrequently recorded scale. Heavy infestations were found on some of the oaks, *Quercus robur* and *Q. nigra* on The Mound. It was also on *Gleditisia caspica* in the same locality. This is an unusual host plant for this scale, which is mostly on oak, but a wide range of trees and shrubs is recorded in Ben-Dov (1993).

Saissetia oleae (Olivier, 1791) Black Hemispherical Scale.

In the glasshouse on *Myoporum leatum*. This scale is restricted to heated glasshouses in Britain.

ERIOCOCCIDAE

⋆ *Cryptococcus fagisuga* Lindinger, 1936 [= *C. fagi*] The Felted Beech Coccus.

On the bark of beech, *Fagus sylvatica*. Described as fairly numerous in 1964, but not found in any quantity in 1997. It is a common scale on beech, but favours trees which have relatively thin bark.

(*Pseudochermes fraxini* (Kaltenbach, 1860))

Recorded as numerous and well established on most ash trees, *Fraxinus* sp., in the Palace Garden in the earlier survey, but not found in 1997.

PSEUDOCOCCIDAE

(*Phenococcus aceris* (Signoret, 1875)

Occurs on a wide range of trees and shrubs. Recorded in the earlier survey as a single nymph on Turkey oak, *Quercus cerris*.

Pseudococcus calceolariae (Maskell, 1879) [= *P. fragilis* Brain]

Tentatively identified by C. Malumphy from a small cluster on *Viburnum tinus* growing on The Mound, 13.viii.1997.

P. longispinus (Targioni-Tozzetti, 1867) [= *P. adonicum* L.]

On various plants in the glasshouse. A common pest of many indoor plants.

P. viburni (Signoret, 1875) [= *P. obscurus* Essig]

A common glasshouse mealybug. Tentatively identified by C. Malumphy from specimens collected from *Myoporum leatum* in the glasshouse.

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The aphids (Hemiptera: Homoptera) of Buckingham Palace Garden

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Abstract

Visits to Buckingham Palace Garden on 22 April 1997 and 9 June 1998 yielded 27 aphid taxa, including seventeen that were not recorded in an earlier survey, carried out in the early 1960s. A further three species not found on their host plants were taken in a Malaise trap, bringing the total number of aphids known from the Garden to 82, about 13% of the known British fauna. No Adelgidae or Phylloxeridae were recorded.

Introduction

Aphids (Aphidoidea: Adelgidae, Phylloxeridae and Aphididae) are well known pests of agriculture and horticulture, both because of their feeding damage due to removal of sap and in some cases toxic saliva, but more particularly because of their virus transmitting ability. Most of the major crops of temperate agriculture suffer from aphid-transmitted viruses. More than two hundred plant viruses are known to be transmitted by more than two hundred species of aphids. Only a small proportion of the world's 250,000 vascular plants have had their viruses investigated and only about 5% of the world's 5,000 known species of aphids have been tested as vectors of any virus. Because of their abundance, aphids are the food of many other organisms, including birds, ladybird beetles (Coccinellidae), hoverfly larvae (Syrphidae) etc, and are parasitised by many small wasps and some flies. These parasitoids are in turn parasitised by other small wasps (hyperparasites) and in some cases tertiary parasites are known. The great majority of these food webs remain to be investigated. In many cases, the parasitoids of aphid predators belong to the same genus as the aphid parasitoids. Again the ecological and evolutionary implications have been little investigated.

Aphids differ from many other groups in having most species in the northern temperate region and fewer species in the tropics and in the southern hemisphere. However, there are a number of small groups known mostly from the tropics and the southern hemisphere, which may be relics of different situations in the past. Greenfly are often thought of as pests of herbaceous plants and the young growth of shrubs, but this is due to the preponderance of one subfamily, the Aphidinae, in the northern hemisphere. Most subfamilies of aphids are associated with trees and the group probably evolved before the evolution of herbaceous flowering plants, which only a few subfamilies of aphids managed to colonise.

Methods

The Garden was visited on 22 April 1997 and 9 June 1998, when aphids were observed on their host plants and samples of uncertain identity were collected for more detailed study. Catches from a Malaise traps operated from 1995 to 1997 were sorted by Colin Plant and also made available.

Results and Discussion

Eastop (1964) reported 60 aphid taxa encountered during a survey carried out in the early 1960s. Fourteen of the aphids recorded in that work were seen again during the current project and an additional seventeen species were also found; two other species collected in the earlier survey have been identified. The Malaise trap caught specimens of some of the species found on their host plants and also three additional species. The overall total of 82 aphid species from the Garden is about 13% of the known British aphid fauna. The small proportion of the fauna found probably reflects the absence of habitats particularly favoured by aphids, such as well-drained sunny banks with a diverse flora and population of ants. Many aphids feed on roots, but as there are limitations in digging up plants in other people's gardens these habitats were not examined in as much detail as more aerial ones.

An annotated list of aphids recorded in Buckingham Palace Garden

Nomenclature follows Remaudière & Remaudière (1997). Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

HOMOPTERA

APHIDOIDEA

APHIDIDAE

ERIOSOMATINAE (PEMPHIGINAE of the earlier account)

* *Eriosoma patchiae* (Börner & Blunmck, 1916)/*ulmoscedens* Marchal, 1919

In distorted leaves of *Ulmus campestris* in early summer and winged sexupara of *E. umoscedens* Marchal in the Malaise trap, 17–24.viii.1995. *E. patchiae* migrates to the roots of *Senecio*, including *S. cineraria*, in early summer and returns to elm in late September or October. The wingless spring forms of *patchiae* and *ulmosedens* are not separable and they may not really be different species.

(*Tetraneura ulmi* (L., 1758))

From roots of *Poa annua*. The overwintering egg is laid on elm and galls are produced on the upper surface of leaves in May and June These open to release winged forms, which fly to grasses.

Patchiella reaumuri (Kaltenbach, 1843)

Malaise trap, 11.vii.–1.viii.1996. This aphid overwinters on linden, *Tilia* spp., where in the spring it makes 'leaf nests' on young growth, particularly suckers from the base of the trunk, and then spends the summer on the roots of *Arum*.

(*Pemphigus bursarius* (L., 1758))

Gall on the leaf petiole of *Populus nigra*. Summer is spent on the roots of lettuce and sowthistle.

(*Pemphigus* sp.)

From roots of *Hydrocotyle vulgaris*, not certainly distinct from *P. bursarius*.

Aploneura lentisci (Passerini, 1856)

Malaise trap, 20–28.vii.1995. Normal hosts in England are grass roots, and it is common in wax wool on the roots on *Poa annua*. Primary hosts in the Mediterranean region *Pistacia* species as in other Fordini.

(*Forda formicaria* von Heyden, 1837)

From *Poa annua* roots.

PHLOEOMYZINAE

(*Phloeomyzus passerinii* Signoret, 1825)

In wax wool on the bark of *Populus nigra*.

ANOECIINAE

Anoecia sp.

Malaise trap, 7–22.ix.1995 and 11.vii.–1.viii.1996. Vagrant alata 9.vi.1998. Most *Anoecia* overwinter on *Cornus* and spend the summer on grass roots.

DREPANOSIPHINAE

⋆ *Drepanosiphum platanoidis* (Schrank, 1801)
Under leaves of *Acer pseudoplatanus.*

PHYLLAPHIDINAE

Phyllaphis fagi (L., 1767)
On Fagus, 9.vi.1998. In the 1960s survey it was found in waxwool under leaves of *Fagus silvatica*, including varieties *purpurea* and dawyck.

CALAPHIDINAE (= DREPANOSIPHINAE in part, in the previous account).

⋆ *Euceraphis betulae* (Koch, 1855) (= *punctipennis* of the previous account)
9.vi.1998. In the earlier survey it was found under leaves of *Betula* sp.

(*Betulaphis quadrituberculata* (Kaltenbach, 1843))
On leaves of *Betula allegeniensis.*

⋆ *Myzocallis boerneri* Stroyan, 1957
9.vi.1998 on *Quercus cerris.* In the earlier survey it was found under leaves of *Q. ilex.*

⋆ *Myzocallis coryli* (Goeze, 1778)
9.vi.1998. In the earlier survey it was found under leaves of *Corylus* sp.

(*Pterocallis alni* (De Geer, 1773))
Under leaves of *Alnus* sp.

⋆ *Eucallipterus tiliae* (L., 1758)
9.vi.1998. In the earlier survey it was found under leaves of *Tilia* sp.

SALTUSAPHIDINAE

(*Subsaltusaphis* sp. ? *ornata* (Theobald, 1927))
Vagrant, probably from *Carex.*

CHAITOPHORINAE

(*Chaitophorus capreae* (Mosley, 1841))
On leaves of *Salix caprea.*

Chaitophorus leucomelas Koch, 1854
22.iv.1997, on leaves of *Populus ?nigra.*

(*Chaitophorus niger* Mordwilko, 1929)
Feeding on the outside of *Pontania* galls on *Salix* x *blanda* and on leaves of *S.* x *sepulchralis.*

(*Chaitophorus populialbae* (Boyer de Fonscolombe, 1841) (= *albus* Mordwilko, 1901))
Under leaves of *Populus alba.*

Periphyllus californiensis (Shinji, 1917)
On young shoots and under leaves of *Acer palmatum* var. *heptalobum* on 22.iv.1997, and aestivating as first instar larvae.

(*Periphyllus testudinacea* (Fernie, 1852) (= *testudinatus* Thornton, 1852))
Under leaves of *Acer rubrum* in spring and aestivating as first instar larvae.

(*Sipha glycerinae* (Kaltenbach, 1843))
On grasses near The Lake.

PTEROCOMMATINAE

Pterocomma sp.,
22.iv.1997. Vagrant alata *Pterocomma* spp. live on the twigs of poplars and willows.

APHIDINAE

(*Aphis cytisorum* Hartig, 1841)
On *Laburnum.*

⋆ *Aphis fabae* Scopoli, 1763
On *Euonymus americanus* and on *Viburnum,* 22.iv.1997 and on *Chrysanthemum* and *Heracleum mantegazzianum* and *Malus toringiodes*, 9.vi.1998. In the earlier survey on *Philadelphius, Rumex, Lythrum salicaria* and *Chaenomeles.*

(*Aphis grossulariae* Kaltenbach, 1843)
On *Ribes uva-crispa*, spends the summer on *Epilobium*.

(*Aphis ilicis* Kaltenbach, 1843)
On *Ilex aquifolium*.

Aphis nasturtii Kaltenbach, 1843
9.vi.1998, on *Lythrum salicaria*. Some populations, at least, overwinter on *Rhamnus*.

* *Aphis pomi* De Geer, 1773
9.vi.1998, on *Malus toringoides*, *Sorbus umbellata* and *Pyrus communis*. In the earlier survey found on *Malus* sp. and *Pyrus communis*.

(*Aphis salicariae* Koch, 1855 (= *corniella* Hill Ris Lambers, 1935))
On *Cornus* spp. in spring and autumn, and on *Epilobium adenocaulon* in the summer.

Aphis sp.
On *Hypericum* sp.

(*Rhopalosiphum insertum* (Walker, 1849))
On Crataegus, *Malus floribunda*, *Malus* sp. Live at soil level on grasses in summer.

(*Rhopalosiphum padi* (L., 1758))
On *Dactylis glomerata* and undetermined grasses. Some populations overwinter on *Prunus padus*.

(*Schizaphis palustris* (Theobald, 1929))
On *Poa annua*.

(*Dysaphis devecta* (Walker, 1849))
In red leaf-edge galls on *Malus floribunda*.

Dysaphis radicola (Mordwilko, 1897)
22.iv.1997, on base of stem of *Rumex ?obtusifolius*.

Ceruraphis eriophori (Walker, 1848)
Large colonies on *Viburnum carlsii*; small colonies on *V. burckwoodii* on 22.iv.1997. Spends the summer on *Carex*, *Eriophorum* or *Luzula*.

* *Brachycaudus helichrysi* (Kaltenbach, 1843)
On *Prunus cerasifera* 'Pissardii' on 22.iv.1997 and on many other plants, particularly Compositae, including *Achillea millefolium* and *Chrysanthemum* in the Garden.

(*Nasonovia ribisnigri* (Mosely, 1841))
On lettuce, overwinters on *Ribes*.

* *Liosomaphis berberidis* (Kaltenbach, 1843)
22.iv.1997, on *Mahonia*, and parasitised by *Aphidius hortensis* Marshall (Braconidae). In the earlier survey found on *Berberis*.

Longicaudus trirhodus (Walker, 1849)
On *Rosa* cultivar, 22.iv.1997. It spends the summer on *Aquilegia*.

(*Rhopalomyzus poae* (Gillette, 1908))
On grasses; overwinters on *Lonicera alpigena*.

(*Brevicoryne brassicae* (L., 1758))
The mealy cabbage aphid, in the Malaise trap sample for 31.viii.7.ix.1995.

(*Cavariella aegopodii* (Scopoli, 1763))
On *Salix* sp. in the spring, spending the summer on many Umbelliferae.

Cavariella pastinacae (L., 1758)
In the Malaise trap sample for 20–28.vii.1955; alternates between *Salix* and *Heracleum*, more rarely *Pastinaca*.

(*Cavariella theobaldi* (Gillette & Bragg, 1918))
On *Salix* and an undetermined umbelliferous plant, perhaps *Angelica*. Commonly found on *Heracleum* and *Pastinaca* and more rarely other Umbelliferae.

(*Myzaphis rosarum* (Kaltenbach, 1843))
On *Rosa*.

(*Chaetosiphon tetrarhodum* (Walker, 1849))
On *Rosa.*

(*Capitophorus horni* ssp *gynoxantha* Hill Ris Lambers, 1953)
On *Cirsium arvense.*

(*Myzus ascalonicus* Doncaster, 1946)
Flying. An almost polyphagous aphid.

(*Myzus cerasi* (F., 1775))
On *Prunus avium*; goes to *Galium* and some *Cruciferae* in early summer.

(*Myzus cymbalariae* Stroyan, 1954)
On lettuce.

(*Myzus ligustri* (Mosley, 1841))
On *Ligustrum ovalifolium.*

Myzus lythri (Schrank, 1801)
On *Lythrum salicaria*, 22.iv.1997; overwinters on *Prunus mahaleb.*

Myzus ornatus Laing, 1932
On *Abelia* sp. (parasitised by an *Aphidius* (Braconidae), 22.iv.1997), and on *Veronica hebe.*

(*Myzus persicae* (Sulzer, 1776))
On *Antirrhinum, Chrysanthemum, Dianthus,* lettuce, *Salvia, Zinnia.* Some populations overwinter on peach.

Myzus varians Davidson, 1912
9.vi.1998, on *Clematis montana* var *grandiflora.* Overwinters on peach.

Phorodon humuli (Schrank, 1801)
22.iv.1997, on *Prunus cerasifera* 'Pissardii'; spends the summer on hops.

(*Ovatus* sp.)
On *Crataegus* sp.. *Ovatus* spp. spend the summer on Labiatae including mint.

(*Megoura viciae* Buckton, 1876)
On *Lathyrus pratensis.*

Wahlgreniella nervata (Gillette, 1908)
22.iv.1997, On *Arbutus* x *andrachnoides.*

(*Amphorophora rubi* (Kaltenbach, 1843))
On cultivated *Rubus.*

Microlophium carnosum (Buckton, 1876)
22.iv.1997, on *Urtica dioica*, on which there were also adult *Coccinella 7-punctata.*

(*Acyrthosiphon pisum* (Harris, 1776))
On *Lathryus pratensis.*

(*Hyalopteroides humilis* (Walker, 1852))
On *Dactylis glomerata.*

(*Metopolophium albidum* Hille Ris Lambers, 1947)
In flight. The host plant is *Arrhenatherum.*

(*Metropolophium dirhodum* (Walker, 1849))
On *Rosa*, the primary host, and undetermined grasses (summer hosts).

(*Metopolophium festucae* (Theobald, 1917))
On *Festuca rubra.*

(*Sitobion avenae* (F., 1775))
On *Dactylis glomerata.*

(*Sitobion fragariae* (Walker, 1848))
On *Festuca rubra.* Overwintes on brambles.

* *Macrosiphum euphorbiae* (Thomas, 1878)
22.iv.1997 on *Rosa.* In the earlier survey, found on *Rosa carolina, Chaenomeles lagenaria,* lettuce, *Phlox*, *Calceolaria* and *Gladiolus.*

Macrosiphum gei (Koch, 1855)
Malaise trap, 24.iv–15.v.1997. Overwinters on *Geum* and spends the summer on *Anthriscus* and related Umbelliferae.

* *Macrosiphum rosae* (L., 1758)
On *Rosa*, 22.iv.1997. In the earlier survey, found on *Ilex aquifolium*. Often in the summer on teasel.

Corylobium avellanae (Schrank, 1801)
On Corylus avellana, 22.iv.1997.

(*Uroleucon cirsii* (L., 1758))
On *Cirsium arvensis*.

(*Macrosiphoniella artemisiae* (Boyer de Fonscolombe, 1841))
On *Artemisia vulgaris*.

(*Macrosiphoniella oblonga* (Mordwilko, 1901))
On *Artemisia vulgaris*.

Lachninae
Maculolachnus submacula (Walker, 1848)
On the ends of shoots of rambler roses growing in shade, 22.iv.1997. Usual habitat is base of the stem or roots of roses.

(*Cinara piceae* (Panzer, 1801))
In the mercury vapour light trap. The host plants are *Picea* spp.

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Lacewings (Neuroptera), snakeflies (Raphidioptera), alderflies (Megaloptera) and scorpion flies (Mecoptera) in Buckingham Palace Garden

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Abstract

Neuroptera were sampled in Buckingham Palace Garden using a single Malaise trap, operated between 20 April 1995 and 18 August 1997 and through regular field survey during the period 1995 to 1997. Twenty-one species were recorded, together with an additional species added during 1998. Five further species recorded in earlier surveys bring the overall total for the Garden to twenty-seven. The species are listed and discussed. No specimens of Raphidioptera, Megaloptera or Mecoptera were recorded during the study.

Introduction

In an earlier survey of Buckingham Palace Garden, carried out in the period from 1961 to 1963 (Richards 1964), rather surprisingly, only three species of lacewing were recorded. There were no records at all of snakeflies (Raphidioptera), alderflies (Megaloptera) or scorpion flies (Mecoptera). A mercury-vapour light trap was operated after termination of that earlier survey, primarily to catch Lepidoptera. Some of the records of lacewings from that trap were subsequently summarised by Kirby (1981), adding a further eight species and bringing the total up to eleven. This paper summarises those published records and reports on additional material obtained through field survey by the author and others during the years 1995 to 1998, from a Malaise trap operated on The Mound from 20 April 1995 to 18 August 1997 and from a mercury-vapour light trap, also positioned on The Mound.

Results

The present survey records twenty-two species of Neuroptera, but there are no examples of Raphidioptera, Megaloptera or Mecoptera. Thirteen of this total have not been recorded before from the Garden; two further species are previously recorded but have not been published. Three taxa (*Chrysopa perla*, *Chrysoperla carnea* agg. and *Wesmaelius subnebulosus*) were recorded during an earlier survey from 1961 to 1963 (Richards 1964) and eleven species were recorded during the 1970s at a mercury-vapour light trap (Kirby 1981). Taken together, these lists combine to produce an overall list of twenty-seven species of Neuroptera for Buckingham Palace Garden of which five have not been recorded for approximately twenty years.

Discussion

There seem to be rather few data on the Neuropterida (Neuroptera, Raphidioptera and Megaloptera) and Mecoptera of the Middlesex vice-county — published or otherwise. The first work of significance to include records from Middlesex was probably the monograph of that group published by The Ray Society (Killington 1936, 1937). A later paper by Pinniger (1946) summarised available knowledge (which was minimal), for five administrative counties affecting the London Area (Middlesex, Kent, Surrey, Hertfordshire and Essex). That work listed nineteen neuropteran species for Middlesex. In a more recent review of the London Area as a whole, Plant (1992*a*) listed 59 species for all time (four Raphidioptera, three Megaloptera, 48 Neuroptera and four Mecoptera), though it was not the intention in that work to produce a list for Middlesex in particular. In a rather more in-depth analysis of records, Plant (1994) produced national distribution maps for all the British Neuropterida and Mecoptera and summarised records of these for the thirteen 'best-recorded' vice-counties. Middlesex ranked tenth, with an all-time list of 41 species, of which 39 were recorded since 1899 and 26 since the end of 1979. An old record of one additional species has been added to the Middlesex total since that work was published, bringing the vice-county list to 42, still with 26 since the end of 1979. The numbers are not directly comparable, since earlier totals did not take account of the recent split in the *Chrysoperla carnea* complex but, nevertheless, the list of eighteen species currently present in Buckingham Palace Garden represents in the order of 70 per cent of the modern total for the vice-county. Species formerly recorded in Buckingham Palace Garden, but apparently no longer present, are shown in Table 1. Species recorded for Middlesex vice-county, but never recorded in Buckingham Palace Garden are presented in Table 2. Since none of the species on the current list for the Garden is particularly unexpected, an examination of the absent species might be rather more illuminating.

TABLE 1. Species of Neuropterida and Mecoptera reported from Buckingham Palace Garden in the past, but for which there are no current records.

Group / species	**Year of last record**
Coniopterygidae	
Semidalis aleyrodiformis (Stephens, 1836)	1974
Hemerobiidae	
Micromus variegatus (Fabricius, 1793)	1979
Hemerobius nitidulus Fabricius, 1777	1979
Chrysopidae	
Chrysopa commata Kis & Ujhelyi, 1965	1976
Chrysopa pallens (Rambur, 1838)	1979

The complete lack of snake flies (Raphidioptera) is not unexpected, since all four British species are, apparently, inhabitants of woodland habitat. *Atlantoraphidia maculicollis* is associated with pines and is most frequently found at the edges of rides in coniferous plantations; it is rather scarce in Middlesex and may even be no longer present. *Phaeostigma notata* seems to have a strict association with oak trees whilst *Xanthostigma xanthostigma* may possibly be similarly associated, though some earlier works (e.g. Fraser 1959) suggest a link with willows.

The absence of alderflies (Megaloptera) is less easily explained, though only *Sialis lutaria* is at all expected here. This species has aquatic larvae that prefer slow or static waters, over a silt substrate. It is a very common insect throughout Middlesex and is noted for its synchronised emergence of adults, usually numbering thousands, along river banks and around lake margins in the spring. Perhaps it is only the lack of submerged and emergent aquatic vegetation in The Lake that prevents this species from colonising?

Sisyra terminalis is another aquatic species and is equally unlikely to occur. Although it is the least often encountered of the British spongeflies, it has been reported from Middlesex in some numbers, but only at a single locality. Peter Barnard noticed the species swarming in large numbers around a bush overhanging the river near the main road bridge at Staines. He caught several specimens on 5 July 1975 (all in BMNH), following a tip-off by Bill Dolling who had caught some specimens at the same spot in June 1973.

TABLE 2. Species of Neuropterida and Mecoptera recorded for Middlesex Vice-county, but never reported from Buckingham Palace Garden.

Group / species	Period of last record for Middlesex
Raphidioptera	
Raphidiidae	
Atlantoraphidia maculicollis (Stephens, 1836)	pre-1980
Phaeostigma notata (Fabricius, 1781)	post-1979
Xanthostigma xanthostigma (Schummel, 1832)	post-1979
Megaloptera	
Sialidae	
Sialis lutaria (Linnaeus, 1758)	post-1979
Neuroptera	
Sisyridae	
Sisyra terminalis Curtis, 1854	pre-1980
Coniopterygidae	
Parasemidalis fuscipennis (Reuter, 1894)	post-1979
Hemerobiidae	
Drepanepteryx phalaenoides (Linnaeus, 1758)	post-1979
Micromus angulatus (Stephens, 1836)	pre-1980
Hemerobius pini Stephens, 1836	pre-1980
Hemerobius simulans Walker, 1853	post-1979
Wesmaelius nervosus Fabricius, 1793	post-1979
Wesmaelius concinnus (Stephens, 1836)	pre-1900
Sympherobius pellucidus (Walker, 1853)	post-1979
Chrysopidae	
Dichochrysa ventralis (Curtis, 1834)	pre-1980
Nineta vittata (Wesmael, 1841)	pre-1980
Mecoptera	
Boreidae	
Boreus hyemalis (Linnaeus, 1767)	pre-1980
Panorpidae	
Panorpa communis Linnaeus, 1758	post-1979
Panorpa germanica Linnaeus, 1758	post-1979

The absence from the current survey of rather small species such as the wax-fly *Semidalis aleyrodiformis* is possibly due to these having been overlooked. Similar comments might apply equally to *Parasemidalis fuscipennis,* which has never been recorded in the Garden. However, Neuroptera associated with pines are rather more of a mystery. They are represented on the Garden list by three species — *Conwentzia pineticola, Hemerobius stigma* and *Nothochrysa capitata* — and the absence of some of the other pine-associated species, such as *Hemerobius nitidulus, H. pini* and *Wesmaelius concinnus* is difficult to explain. Killington (1937) asserted that *Sympherobius pellucidus* is also associated with pines, though that assertion is challenged by recent data (Plant, 1994).

Also restricted to coniferous trees, though not pines, is *Hemerobius simulans.* It is confined largely to larch *Larix* spp., but is perhaps also on spruce *Picea* spp. It is not expected in Buckingham Palace Garden.

Micromus angulatus is a very local species that is not at all expected in a built-up, urban area. Likewise, the distinctive *Drepanepteryx phalaenoides,* which is a species of mature woodland containing a high proportion of oak.

The green lacewing *Chrysopa commata* was also recorded once only, also in June 1976 and it is interesting to speculate that this may have been 'called down' by the light trap from the 'aerial plankton'; the summer of 1976 was exceptionally hot and dry for a prolonged period. *Chrysopa pallens* was also recorded at the same period but, interestingly, was also recorded again in 1979. Perhaps it is still present? It is a common species in suburban gardens and appears to be able to thrive on a wide range of deciduous tree species. *Dichochrysa ventralis* is less frequently found than *D. prasina* but is, nevertheless, a widespread and common lacewing on a variety of deciduous trees. *Nineta vittata* may prefer woodlands, from choice, but also turns up in light traps in suburban gardens whilst the absence of *Wesmaelius nervosus* is a complete mystery as it is a common species in the general area.

As far as the Mecoptera are concerned, the absence of the elusive snow-flea *Boreus hyemalis* is perhaps less of a surprise than that of the two common scorpion flies, *Panorpa communis* and *P. germanica*. Evidence from much field survey over the past twenty years appears to reveal some sort of association between these species and stinging nettles *Urtica dioica* growing in the presence of brambles *Rubus fruticosus* agg. On the other hand, it is possible that the general mix of rank herbage and scrub, combining to form the right sort of cover, is more important and that coincidence has it that these two plant species regularly combine to form the same conditions. Either way, this type of habitat is absent from Buckingham Palace Garden, but there is a very high likelihood of one or both scorpion flies colonising the Garden should these correct conditions ever be created.

Conclusions

There are always new species to be added to the list for any site and it is more or less impossible ever to be in a position to state that a survey is completed! However, there are some occasions where one can come close, and a survey of a walled, isolated, green oasis in the central urban sprawl of London might just be such an example. If one assumes that the post-1979 Middlesex list provides a pool of available species, only four, *Chrysopa pallens, Dichochrysa ventralis, Nineta vittata* and *Wesmaelius nervosus*, are at all likely to remain under recorded in Buckingham Palace Garden. Although further light trapping will most likely attract additional species that might merely be passing overhead, it is at least moderately safe to conclude that the list of Neuropterida and Mecoptera obtained is more or less fully representative of the currently resident species.

An annotated list of the Neuropterida and Mecoptera recorded in Buckingham Palace Garden

Sequence and nomenclature follow Plant (1994), except that genus *Dichochrysa* is used in place of *Mallada*, in accordance with Yang and Yang (1990). Species found in the 1961–1963 survey, but not in the present study, are enclosed in round brackets. Taxa recorded in the years between 1963 and 1981, and listed in Kirby (1981) are annotated with a hash (#). Taxa recorded in both the 1960s and 1990s surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey or are reported now for the first time. Species entries entirely enclosed within square brackets are erroneously recorded species, mentioned here because they have been published previously.

NEUROPTERIDA
NEUROPTERA
CONIOPTERYGIDAE

Conwentzia psociformis (Curtis, 1834)

Single males were identified in Malaise trap samples for 20–27.vii.1995, 3–10.viii.1995 and 31.viii.–7.ix.1995. Males were occasionally disturbed from a variety of deciduous bushes and trees, and one from ivy, during visits in July. Females, of which several were encountered, cannot be separated reliably from *C. pineticola* Enderlein. This is a common species in London, but is hopelessly under recorded and is doubtless missed in light trap and Malaise trap samples because of its minute size. It is evidently a well-established species in Buckingham Palace Garden.

Conwentzia pineticola Enderlein, 1905

Single males were identified in Malaise trap samples for 20–27.vii.1995 and 3–10.viii.1995. These are the only records for this species here, the presence of which was not noted in Britain until the 1970s (Barnard 1978) when it was realised that examination of male genitalia is critical to correct determination. Evidence from Rothamsted Insect Survey light traps across Britain suggests, however, that it is equally common and widespread as *C. psociformis*. My earlier statement (Plant 1994) that it appears to be strictly associated with Scots pine *Pinus sylvestris* appears to hold true. These trees are invariably present in the vicinity of all British records and are, indeed, present in Buckingham Palace Garden (McClintock and Lane *antea*, 46).

Coniopteryx (Coniopteryx) tineiformis Curtis, 1834

Eleven males were present in Malaise trap samples for July and August for all three years of the present survey. This is a widespread and common species across the whole of the British Isles and is also frequent in the London Area. The larvae can be found by careful searching on a variety of deciduous trees, though they were not searched for in Buckingham Palace Garden.

Coniopteryx (Coniopteryx) borealis Tjeder, 1930

At the time of Killington's 1936 monograph, *C. borealis* was known only from two specimens collected in Scotland in 1903 and 1934. A specimen collected in Surrey in 1895 was found under the label of '*tineiformis*' in the National Museum of Wales (Plant 1994). In recent years, however, examination of the male genitalia of examples from the Rothamsted Insect Survey light traps, and other sources, has shown that this species is widespread and very common across Britain (though there are no Irish records at present). In Buckingham Palace Garden nine examples were found in the Malaise trap samples for July and August in 1995 and 1996 and a male was taken in the light trap on 8 June 1995.

#*Semidalis aleyrodiformis* (Stephens 1836)

Kirby (1981) records this species as a single female from the m.v. trap in the Garden on 5.viii.1974. The reliability of determinations based upon females in the Coniopterygidae is, even today, generally unreliable. However, the genus was at that time represented in Britain by only a single species: *S. pseudouncinata* Meinander was not added until 1990 and is regarded as a new arrival on imported Cupressaceae (Plant 1992). The record is, therefore, taken as reliable.

Semidalis pseudouncinata Meinander, 1963

A single male of this small wax-fly was collected in the light trap on The Mound on 28.vii.1995 and represents the only example of this species for the Garden and a new vice-county record for Middlesex. A recent colonist to Britain, it was first noted at Writtle, Essex and Wisley, Surrey during 1990 (Plant 1992b); the Buckingham Palace record rather neatly connects the two from either side! It is associated with ornamental Cupressaceae and was probably artificially aided in its arrival in Britain. However, in the years prior to 1990 it seemed to exhibit a gradual northwards progression across Europe (P. Leraut, pers. comm.); a species introduced with horticultural items might be expected to jump to new areas rather than show a gradual range expansion.

SISYRIDAE

#*Sisyra fuscata* (Fabricius, 1793)

Kirby (1981) lists records from the m.v. trap as follows: 1♂ on 13.viii.1973; 3♀♀ on 4.viii.1975; 1♂1♀ on 8.viii.1975; 1♂ on 3.x.1975; 1♂ on 27.vi. 1979. He clearly missed the record from the same trap on 13.viii.1978. The present survey revealed only a single record, of 1♂ in the Malaise trap sample for 5–20.v.1995. The larvae of this species live as internal parasites in freshwater sponges, of which none is so far recorded from Buckingham Palace Garden. Winter is passed in the prepupal stage and once emerging adults have mated, eggs are laid in clusters under branches, bridges or other objects overhanging water. After hatching, the first instar larva drops into the water below. The failure to record this species during the current survey, other than as a single specimen in the Malaise trap is scarcely surprising.

HEMEROBIIDAE

#*Micromus variegatus* (Fabricius, 1793)

Kirby (1981) lists single females in the light trap on 12.vii.1974 and 13.viii.1979. Perhaps surprisingly, there are no other records available. It is associated with tall grasses and rank herbage, often in association with bushes. The majority of British records are from pitfall traps, though it is occasionally taken in light traps or captured in sweep-net samples.

Micromus paganus (Linnaeus, 1767)

Prior to the present survey, three were taken in the light trap by John Bradley on 11.v.1981 and another on 2.vi.1983. All current records are from the Malaise trap, with one male in the sample for 7–20.v.1995, four males in that for 6–18.vi.1996 and one male in that for 24.iv.–15.v.1997. This is an extremely common species in the London Area, though almost all records are made at light traps. There is a strong association with low herbage and the larvae are almost certainly predators of root aphids. Presumably in a garden site, where there is constant disturbance of the soil, there will be few areas where root aphids can become established for long enough to support *Micromus* lacewings?

Hemerobius humulinus Linnaeus, 1761

This is evidently a common species in the Garden, as elsewhere in London and the rest of Britain. It comes freely to light traps so it is rather a surprise that Kirby (1981) did not record it. In total, 25♂♂ and 11♀♀ were caught in the Malaise trap over the three-year survey period; the records span the period of May to August, though with a small peak in July. Adults of both sexes were regularly beaten from shrubbery and trees in July 1996 and were also noted in the light trap.

Hemerobius stigma Stephens, 1836

A single female taken in the light trap on The Mound on 13.vii.1995, and a second female in that trap on 24.viii.1995, are the only records. This relatively widespread and common species is strictly associated with pine trees, showing a preference for Scots pine *Pinus sylvestris,* but not exclusively so, and rarely wanders far from areas where the trees are present.

#*Hemerobius nitidulus* Fabricius, 1777

A single male recorded by Kirby (1981) in the light trap for 13.viii.1979 is the only record. Kirby commented that this was an unexpected species associated with conifers and that it was probably a contemporary introduction.

Hemerobius micans Olivier, 1792

Available evidence from across the British Isles suggests that this brown lacewing is strictly associated with oak trees. In Buckingham Palace Garden all records emanate from the Malaise trap on The Mound, 24♂♂ and 17♀♀ over the three-year period, with records from May to October inclusive. It is most surprising that this species was not recorded by Kirby (1981) as it comes regularly to m.v. light traps.

#*Hemerobius lutescens* Fabricius, 1793

One male and one example with no abdomen are recorded by Kirby (1981) in the light trap for 4.viii.1975 and a single male was in the trap on 15.vi.1976. In the present survey, records are also surprisingly sparse. The Malaise trap records 1♂1♀ from 7–20.v.1995, 2♀♀ from 27.vii.–3.viii.1995, 1♂ from 10–17.viii.1995 and 2♂♂ from 25.iv.–15.v.1997 whilst there was a male in the light trap sample for 8 June 1995. None were found by beating or sweeping vegetation and, surprisingly, there are no other records of this normally widespread and very common species.

*#*Wesmaelius (Kimminsia) subnebulosus* (Stephens, 1836)

Richards (1964) noted this species at light in the Garden in July, September and October, adding that it was then common in London parks and gardens. Records listed by Kirby (1981) indicate that this brown lacewing was regular in the 1970s in the light trap: 1♀ on 19.vii.1972; 1♀ in v.1973; 1♀ on 12.vii.1974; 2♂♂ on 4.viii.1975; 1♂ on 6.viii.1975; 2♀♀ on 8.viii.1975; 1♀ on 28.vi.1976; 1♂ on 29.ix.1977; 1♂ on 13.viii.1979. For the present survey, 41♂♂ and 11♀♀ are recorded from the Malaise trap between 7 May 1995 and 18 August 1997, covering the months from May to August. In addition, both sexes were regularly beaten from bushes during visits in the same months, and also in September, and single examples of females were taken in the light trap on 13 and 20.vii.1995. Of particular interest was a single female, apparently hibernating in a curled leaf caught up in bushes in the Garden, on 21.ii.2000, which I discovered whilst searching for over-wintering *Chrysoperla carnea.* This seems to be the first record of this species during the winter period in Britain. Interestingly, however, there are previous records of overwintering by this species further south in Europe. According to Laffranque and Canard (1975), 'All stages endure cold .... When the imagos (*sic*) over-winter, mating, vitellogenesis and oviposition occur if they receive suitable food'. Their work was carried out in the Toulouse region of south-west France.

#*Sympherobius (Sympherobius) pygmaeus* (Rambur, 1842)

Kirby (1981) lists examples from the light trap as follows: 1♂ on 9.vi.1976; 1♂ on 14.vi.1976; 2♂♂1♀ -on15.vi.1976. During the present survey there was a single female in the light trap on 28.vii.1995 . This species is seldom encountered other than at light traps or in Malaise traps; it is apparently confined to oak trees.

CHRYSOPIDAE

[*Chrysopa phyllochroma* Wesmael, 1841.

Recorded in error by Kirby (1981). See discussion under *Chrysopa commata*].

#*Chrysopa commata* Kis & Ujhelyi, 1965

Kirby (1981) describes a single female green lacewing, taken in the light trap for 9.vi.1976 and, after a somewhat lengthy discussion, dismisses all British records of *C. commata* (including this one), as being *C. phyllochroma*. It is clear from the discussion that Kirby did not regard the two taxa as being validly separate species. Modern opinion differs, however, and Kirby's description of the Buckingham Palace specimen as having dark lateral thoracic sutures clearly indicates that the specimen was *C. commata*. There are no other records from the Garden. Elsewhere in Britain, *C. commata* is widespread, but very local, in the southern half of England, whilst *C. phyllochroma* extends over the same geographical area, but is either numerically rare or else is difficult to find (Plant 1994).

#*Chrysopa perla* (Linnaeus, 1758)

Kirby (1981) lists a single example, without an abdomen, in the light trap sample for 12.vi.1970. For the present survey there are two records, both of single females, in the Malaise trap for the fist week of July and the first week of August, both in 1995. There are no other records of this very common London species, which is generally associated with rank herbage, especially grassland with scattered scrub.

#*Chrysopa pallens* (Rambur, 1838)

Three separate females were taken in the light trap, with one each on 22.vii.1975, 1.vii.1976 and 12.ix.1979 (Kirby 1981). There are no other records. This is the *Chrysopa septempunctata* Wesmael of many recent texts.

*#*Chrysoperla carnea* agg.

In recent years Henry et al. (1996; 1999; submitted) have shown that what was previously understood to be *Chrysoperla carnea* in Western Europe is in fact a complex of five cryptic species. They can be segregated on the basis of their unique substrate-borne courtship 'songs', and the morphology of the genital lip at the apex of the male abdomen. Of these five taxa, three occur in Britain. All three are recorded in Buckingham Palace Garden, but old records for which there is no voucher specimen cannot be segregated. Work is still in progress to establish the correct scientific names for two of these species (Henry et al., submitted) so in this paper they are referred to informally as *Chrysoperla* sp. A and *Chrysoperla* sp. B. Henry et al. (submitted) provide a full morphological description of how to distinguish adults and larvae of these two species.

Chrysoperla lucasina (Lacroix, 1912)

In fresh specimens, and those preserved in alcohol, this species can be distinguished by the dark brown, chitinised stripe on the membrane between tergites and sternites, positioned adjacent to the margin of sternites 1 to 3. The diagram of this feature in Plant (1997), as well as the characters given in the key in that work, is misleading and should not be used. Pinned specimens are best treated for a short period in potassium hydroxide and then stored in alcohol before correct identification can be carried out. *C. lucasina* appears to be very widespread in Britain, and is likely to be found in most areas, though it is numerically rare compared to species B, below. In Buckingham Palace Garden, the Malaise trap produced just a single example — a female in the sample for 23.ii.–25.iii.1996. This compares with totals for the three-year period of 56 species A and 37 species B. Another single example, this time a male, was found in the light trap sample for 20.vii.1995.

Chrysoperla species A

This is segregate *Cc2* of Duelli, the 'slow motorboat' song morph *sensu* Henry and *Ch. carnea sensu* Cloupeau. At present, Buckingham Palace Garden is the only confirmed British locality for this segregate, although there are unconfirmed samples from another London site (within South Essex, vice-county 18) where I found examples in Malaise trap samples collected in 1994. At Buckingham Palace, the Malaise trap records 56 examples (35♂♂, 21♀♀) between 20 April 1995 and 18 August 1997, affecting every month of the year except June, providing clear evidence that this segregate overwinters in Britain as an adult. The gap in records for June is unexpected, but may indicate a break between generations. Active searching for this species in the Garden was undertaken by Stephen Brooks and myself on 21 February 2000. A search of the buildings proved to be fruitless, but our spirits rose when adult lacewings, in both green and brown colour phases, started to fall into our beating tray from cherry laurel *Prunus laurocerasus* bushes. Close examination of the habitat showed that most lacewings were inside dried, folded and rolled leaves of plane *Platanus* × *hybridus* trees that had become deeply lodged in the evergreen bushes; most were in bushes that received direct sunlight and were sheltered from the wind. Both species A and B were found in this situation.

Chrysoperla species B

This is segregate *Cc4* of Duelli, the 'motorboat' song morph *sensu* Henry (Henry et al. 1996; 1999; submitted) and Ch. kolthoffi sensu Cloupeau. This segregate species is widespread and numerically abundant over the whole of Great Britain, though information is not currently available from Ireland. It is, however, less common than species A in Buckingham Palace Garden — itself an interesting discovery. In total 37 examples (19♂♂ and 18♀♀) were collected by the Malaise trap over the same time period as the 56 of species A, above. Examples were also found hibernating inside curled-up leaves of plane trees in the same situation as species A and occasionally in the light trap. Records are distributed across all months of the year except December.

* *Cunctochrysa albolineata* (Killington 1935)

Richards (1964) records this species 'at light and on shrub' for June and July in the 1961 to 1963 survey. Kirby (1981) lists two males in the light trap for 4.viii.1975. A larva collected during September 1982 by Stephen Brooks emerged as an adult on 23 May 1983. The present survey records a total of 6♂♂ and 4♀♀ in the Malaise trap over the months of May to September but, interestingly, none was found during active survey work. It is a very common species in London with only taxa in the *Chrysoperla carnea* complex being more numerically abundant in light traps.

Dichochrysa flavifrons (Brauer, 1850)

This is a widespread and common species in England and Wales, though it is recorded only once in Ireland and is apparently absent from Scotland. In the south-east of England it is frequent at light traps and there is some unpublished numerical data to suggest that resident populations are boosted by autumn immigration from Europe. Surprisingly, however, there is only a single record from Buckingham Palace Garden — a female in the Malaise trap sample for 23–30.vi.1995.

Dichochrysa prasina (Burmeister, 1839)

This is a common species in suburban gardens, including in London, though there are no other records to date for the central area than the present one of a single female in the Malaise trap sample for 20–27.vii.1995.

Nineta flava (Scopoli, 1763)

Absent from both the 1961–1963 list and from Kirby's 1981 report, this species was first recorded from the Garden on 27.vii.1981, when John Bradley collected a single example from the light trap. It is represented in the 1990s survey by just two examples, both in the Malaise trap samples — 1♀ from 23–30.vi.1995 and 1♀ from 27.vi.–11.vii.1996. Killington (1937) recorded this large green lacewing by beating hazel, lime, oak and beech, whilst Kirby (1981) asserted that it might be expected in Buckingham Palace Garden because it has a strong association with *Acer*. However, as I have previously stated (Plant 1994), there is a strong association with oak, and oak trees have proved, in situations where checking has been possible, to be in the vicinity of all other trees from which examples of the lacewing have been disturbed. If there truly is an association with *Acer* trees (sycamore or London planes) then one might expect the species to be tolerably common in the central area of London, including in Buckingham Palace Garden, but the reality seems to be that it is genuinely rare here (though it is common in the suburbs). Oak is present in the Garden, and clearly supports a population of *Hemerobius micans*.

#*Nothochrysa capitata* (Fabricius, 1793)

A single female from the light trap on 25.vi.1974 is listed by Kirby (1981). An earlier female was collected by John Bradley from the light trap on 23.vii.1969 whilst more recently Peter Chandler collected a single female in the Garden on 26.vi.1998. These appear to be the only records of a species that seems to have an association with pine trees.

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PLATE H. Buckingham Palace Garden, London. Tree-dominated edge-habitats, such as here alongside Grosvenor Place, are important for many species of insects.

Photographed © by Mark Lane

The Butterflies and Moths (Lepidoptera) of Buckingham Palace Garden

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Abstract

Lepidoptera have been monitored over a period of 40 years in Buckingham Palace Garden, mostly by use of a mercury vapour (m.v.) light trap sited near the western end of the lake. During that period, a total of 640 species have been recorded, comprising 23 butterflies and 617 moths. A little over half of the records (343 species), were made during the four-year survey of the natural history of the Garden from 17 June 1960 to 15 September 1964. In 1965, a further 22 species were recorded, bringing the total to 365. During the following ten years, the total increased to nearly 500, an average of 12 to 14 additional species annually and from then onwards this has gradually declined to just a few species each year. The present inventory represents about 25 per cent of the British lepidopteran fauna. Noteworthy among the moths from the Garden are three species previously unknown from the British isles, *viz. Monochroa hornigi* (Gelechiidae), *Eccopisa effractella* (Pyralidae)and *Earias biplaga* (Noctuidae), the Spiny Bollworm. A synoptic collection of specimens from the garden is maintained in The Natural History Museum, London.

Introduction

The first systematic recording of Lepidoptera at Buckingham Palace Garden was carried out by John Bradley and Robin Mere as part of a survey of the natural history of the garden carried out between June 1960 and September 1964 (Bradley & Mere 1964). During that period a remarkable total of 343 species was listed. Bradley and Mere continued recording and two years later a further 25 species were listed (Bradley & Mere 1966). Bradley continued running the m.v. trap for the next 23 years, and was then joined by the present author who eventually took over observations in 1991, continuing until the present day. After the supplementary list of 1966, no further list was published so that the present account provides new records for a period of over thirty years.

Collecting methods

Most specimens have been collected by use of a Robinson-pattern mercury vapour light trap (see Plate D in Part 1 of this *Supplement*). During the first survey, this was situated in a small open space at the western end of the mound and on a few occasions was run by the lakeside (Bradley & Mere 1966). By the time the current survey was started, the trap had been moved to a small clearing on the mound at the south-western side of the lake. Because of the growth of trees over the years, the site is much more enclosed than it was during the first survey and this, together with increased light pollution in London has meant that the trap is much less efficient and catches are now much smaller. This may be a major factor in accounting for the larger number of species recorded during the first survey. The trap was usually run on one or two nights each week from spring until autumn. The trap was switched on at dusk by a member of the gardening staff and switched off and covered on the following morning. Originally, the trap was checked in the early afternoon, but for part of the survey period it was checked in the early morning to avoid losses.

A considerable number of microlepidoptera species have been recorded from leaf mines, notably during a visit by the late Maitland Emmet in 1997. No doubt a more intensive search for leaf mines would reveal additional species. For the current insect survey, a Malaise trap (see Plate E in Part 1 of this *Supplement*), was also set up on the mound at its eastern end, but this has only produced one notable Lepidoptera record — a single specimen of *Synanthedon vespiformis*, the Yellow-legged Clearwing — the only record of this species for the garden.

Butterflies and day-flying moths have mostly been observed visiting flower borders or attracted to *Buddleja* in the shrubberies.

Discussion

It is difficult to draw any useful conclusions about the many species only recorded once or a few times over the years as this inevitably happens with a group of highly mobile insects such as the Lepidoptera, particularly when they are mainly collected by light trapping. It is quite possible that many of these are resident in the garden but a great deal more work would be necessary to verify this. However, a number of interesting trends have been noticed for some more regularly recorded species.

During the first survey, Bradley & Mere noted that the most common macrolepidoptera in the trap were *Noctua pronuba*, the Large Yellow Underwing, *Mamestra brassicae*, the Cabbage Moth, *Paradrina clavipalpis*, the Pale Mottled Willow and *Lycia hirtaria*, the Brindled Beauty. In the current survey, since 1995, *Noctua pronuba* and *Paradrina clavipalpis* have remained amongst the most common species but the other two species have only been recorded occasionally. Bradley & Mere commented on the relatively low number of Geometridae recorded, citing the fact that many species are not captured by m.v. traps as one of the reasons for this. The current survey has produced even less Geometridae and this may be partly because the trap is now more shaded by surrounding trees and partly because there has not been the opportunity for the type of evening collecting that was carried out during the first survey when Palace security was not so rigorous as it is today.

Among the microlepidoptera, the most common species during the first survey were the tortricid moth, *Rhopobota naevana* and the gelechiid *Carpatolechia fugitivella*. Although both of these species have been recorded during the current survey, they have certainly not occurred in large numbers. However, two species of Blastobasidae, *Blastobasis decolorella* and *B. lignea*, have become extremely common. Both of these species originate from Madeira but are now well established in England. They are both detritus feeders and there is a possibility that their dramatic increase in numbers may be linked to more environmentally sensitive gardening methods now employed at the Palace, including the extensive use of 'home produced' compost for mulching. The most common tortricid moth is now *Epiphyas postvittana*, the Light Brown Apple Moth, another introduced species originating from Australia and discovered in the mid-1930s breeding in Devon and Cornwall. It was first recorded in the garden in 1989, but has significantly increased in numbers during the current survey period. It feeds on the foliage of a wide range of shrubs and garden plants and is almost certainly breeding in the garden. Its sudden increase may be linked with climatic change.

The influence of climatic change is difficult to prove but it is interesting to note that *Euproctis chrysorrhoea*, the Brown-tail Moth, first recorded in the garden in 1967 (Bradley 1984) was not seen again until 1976, but by 1983 was occurring in large numbers and has been recorded regularly since then. This species was previously regarded as surviving at the edge of its range in Britain, being largely confined to a few areas along the south-east coast of England with occasional incursions along the Thames estuary into London.

Climatic change may also be partly responsible for the extending range of some of our butterflies. *Pararge aegeria*, the Speckled Wood, was first recorded in the garden in 1972, but by 1995 had become quite a common sight and is almost certainly breeding there now. This may have been helped by current mowing regimes in some of the wilder areas of the garden, as the larvae feed on grasses. In the first survey, *Celastrina argiolus*, the Holly Blue, was described as the only butterfly species regularly breeding in the garden. This species reached a peak in 1989, but has remained in good numbers each year since then.

An interesting butterfly record, which requires some explanation, is that of *Lycaena dispar*, the Large Copper, a species extinct in the wild in Britain since the 1850s. The following account was kindly supplied by Bradley:

> 'The Water Dock (*Rumex hydrolapathum*) had been specially planted by the lake in 1976 and early 1977 for a trial release of Large Coppers being reared by the Reverend Tony Harbottle, chaplain at Windsor. He had released a number of butterflies in the morning on 3rd August. A gardener, not knowing about this, saw one and managed to catch it with his cap and put it in a match box which he presented to Dr Bradley when he came to inspect the m.v. trap in the afternoon, saying "I've got a good one here!"'

One of the more interesting new records, *Lithophane leautieri*, Blair's Shoulder-knot, discovered in Britain on the Isle of Wight in 1951, made its first appearance in the garden in 1989 and has been recorded quite regularly since then. Its larvae feed on *Cupressus* spp. and its appearance may be linked with the extensive planting of ornamental conifers in London which became practicable following diminished sulphur dioxide pollution levels. *Blastobasis lignea* is also known to feed on conifers, which may partly explain the huge explosion in its numbers. The appearance of *Caloptilia azaleella*, the Azalea Leaf Miner, coincided with extensive plantings of *Rhododendron* in the 1970s, also made possible by reduced sulphur dioxide pollution. Reduced pollution may also account for increasing numbers of the lichen-feeding *Cryphia domestica*, the Marbled Beauty, a species that was only noted twice during the first survey.

Two new records of leaf-mining microlepidoptera have followed recent accidental introductions from the continent. *Phyllonorycter leucographella*, the Firethorn Leaf-miner, a southern European species, was first recorded in Essex in 1989 (Emmet 1989), and in 1990 leaf mines were found on *Pyrracantha* growing along the wall of the Back Path. *Phyllonorycter platani*, a native of south-eastern Europe, mining the leaves of Plane (*Platanus*), was first recorded in South Kensington, London in 1991 (Emmet 1991), but was not noted in the palace garden until 1995, although it was quite probably present before then. It is difficult to know whether climatic shifts played a part in the arrival of these moths but *Phyllonorycter leucographella* almost certainly came into the country on nursery stock.

Perhaps the most exciting find during the current survey period was a single specimen of the pyralid moth *Eccopisa effractella*, a species new to the British Isles (Agassiz 1996). This is a widely distributed species in continental Europe but most likely arrived here as a casual importation. The larvae are said to feed on spun shoots of cultivated Apple, *Malus sylvestris*, with Plum, *Prunus* and Hazel, *Corylus*, as alternative foodplants, so it is feasible that the species could become established here. The gelechiid moth *Monochroa hornigi*, recorded as new to Britain in the first survey was subsequently taken in the light trap in 1963, 1984 and 1987 and has since been recorded as far north as south-east Yorkshire (Bradley 2000). Also, the noctuid moth *Earias biplaga*, Spiny Bollworm, first recorded from the Palace garden in July 1964, has since been recorded elsewhere in southern England (Bradley 2000).

An annotated list of Lepidoptera recorded in Buckingham Palace Garden

With the exception of the butterflies all records are of specimens taken at m.v. light unless otherwise indicated. Species marked * were recorded in the first report by Bradley & Mere in 1964, while those marked ** were recorded in the supplementary list published by Bradley and Mere in 1966. Species in bold have been recorded during the current survey (from 1995 onwards). Species listed as 'first recorded' have been recorded more than once, while those listed as 'recorded' only appear to have been noted once. Nomenclature follows Bradley (2000).

LEPIDOPTERA

ERIOCRANIIDAE

Eriocrania subpurpurella (Haworth, 1828)
First recorded 8.v.1970.

* *Eriocrania unimaculella* (Zetterstedt,1839)

HEPIALIDAE

** *Hepialus humuli* (Linnaeus, 1758), Ghost Moth

Hepialus sylvina (Linnaeus, 1761), Orange Swift
Recorded 16.viii.1974.

Hepialus hecta (Linnaeus, 1758), Gold Swift
Recorded 23.vii.1967.

* ***Hepialus lupulinus* (Linnaeus, 1758)**, Common Swift.
Quite common during the current survey period in May & June, sometimes in large numbers.

NEPTICULIDAE

Bohemannia pulverosella (Stainton, 1849)
Leaf mines recorded by Bradley between 1965 and 1989 on apple (*Malus*) in the kitchen garden.

Etainia decentella (Herrich-Schäffer, 1855)
First recorded 21.vii.1975.

***Ectoedemia louisella* (Sircom, 1849)**
Recorded 24.viii.1995.

* *Ectoedemia albifasciella* (Heinemann, 1871)

Ectoedemia septembrella (Stainton, 1849)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* ***Stigmella lemniscella* (Zeller, 1839)**
Leaf mines subsequently recorded by Emmet & Plant 31.viii.1997.

***Stigmella speciosa* (Frey, 1858)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Stigmella obliquella* (Heinemann, 1862)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

* *Stigmella trimaculella* (Haworth, 1828)

***Stigmella tityrella* (Stainton, 1854)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Stigmella perpygmaeella* (Doubleday, 1859)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, also recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Stigmella ulmivora* (Fologne, 1860)

* *Stigmella atricapitella* (Haworth, 1828)

Stigmella ruficapitella (Haworth, 1828)
Leaf mines recorded by Bradley between 1965 and 1989 but no further data could be traced.

***Stigmella suberivora* (Stainton, 1869)**
Vacated leaf mine on Holm Oak, *Quercus ilex,* 13.vi.1996, first record.

***Stigmella anomalella* (Goeze, 1783)**, Rose Leaf Miner
Leaf mines recorded several times by Bradley between 1965 and 1989 but no exact data could be traced , also recorded by Emmet & Plant 31.viii.1997.

***Stigmella centifoliella* (Zeller, 1848)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

* *Stigmella hybnerella* (Hübner, 1796)

* *Stigmella oxyacanthella* (Stainton, 1854)

***Stigmella crataegella* (Klimesch, 1936)**
24.viii.1995 at m.v., leaf mines recorded by Emmet & Plant 31.viii.1997; also recorded by Bradley between 1965 and 1989.

TISCHERIIDAE

***Emmetia marginea* (Haworth, 1828)**
First recorded 8.viii.1983.

HELIOZELIDAE

Heliozela sericiella (Haworth, 1828)
Recorded 20.v.1982, first Middlesex record.

COSSIDAE

* *Zeuzera pyrina* (Linnaeus, 1761), Leopard Moth

ZYGAENIDAE

* *Zygaena trifolii* (Esper, 1783), Five-spot Burnet
Caught during the daytime. This specimen belongs to the chalk soil form *palustrella*, Verity, 1926, a very unusual occurrence as the nearest records are from the North Downs in Kent and Surrey (Plant, 1993).

* *Zygaena lonicerae* (Scheven, 1777), Narrow-bordered Five-spot Burnet
Caught during the daytime.

PSYCHIDAE

***Dahlica inconspicuella* (Stainton, 1849)**
Larva found in m.v. trap 1.vi.1995, first record.

TINEIDAE

Morophaga choragella (Denis & Schiffermüller, 1775)
Recorded 20.vi.1979.

Nemapogon cloacella (Haworth, 1828), Cork Moth
Recorded 30.v.1996.

***Nemapogon variatella* (Clemens, 1859)**
First recorded 20.v.1982.

* *Monopis laevigella* (Denis & Schiffermüller, 1775), Skin Moth.

* *Monopis obviella* (Denis & Schiffermüller, 1775)

* *Monopis crocicapitella* (Clemens, 1859)

***Monopis imella* (Hübner, 1813)**
Recorded 21.viii.1997.

* ***Tineola bisselliella* (Hummel, 1823)**, Common Clothes Moth

Niditinea fuscella (Linnaeus, 1758), Brown-dotted Clothes Moth
Recorded 7.vi.1988.

* ***Tinea columbariella* Wocke, 1877**

Tinea pellionella Linnaeus, 1758, Case-bearing Clothes Moth
First recorded 6.viii.1979.

* *Tinea pallesecentella* Stainton, 1851, Large Pale Clothes Moth

***Tinea trinotella* Thunberg, 1794**
First recorded 14.vii.1969.

BUCCULATRICIDAE

Bucculatrix maritima Stainton, 1851
First recorded 19.viii.1966.

* *Bucculatrix frangutella* (Goeze, 1783)

Bucculatrix albedinella Zeller, 1839
First recorded 3.vi.1970

***Bucculatrix thoracella* (Thunberg, 1794)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

** *Bucculatrix ulmella* Zeller, 1848

ROESLERSTAMMIIDAE

* *Roeslerstammia erxlebella* (Fabricius, 1787)

GRACILLARIIDAE

***Caloptilia betulicola* (Hering, 1927)**
Recorded 1.vii.1976.

Caloptilia azaleella (Brants, 1913), Azalea Leaf Miner
First reared from mines 18-20.ix.1974.

* ***Caloptilia alchimiella* (Scopoli, 1763)**

***Caloptilia robustella* Jäckh, 1972**
First recorded 11.vi.1996.

* ***Caloptilia stigmatella* (Fabricius, 1781)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

***Caloptilia falconipennella* (Hübner, 1813)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record. First Middlesex record.

* *Caloptilia syringella* (Fabricius, 1794)

Calybites phasianipennella (Hübner, 1813)
Recorded 24.vii.1981

Parornix betulae (Stainton, 1854)
First recorded 24.vii.1972

Parornix fagivora (Frey, 1861)
First recorded 11.viii.1975, first Middlesex record.

***Parornix anglicella* (Stainton, 1850)**
First recorded 17.vii.1964, leaf mines subsequently recorded by Emmet & Plant 31.viii.1997.

***Parornix devoniella* (Stainton, 1850)**
Recorded by Bradley between 1965 and 1989 but no further data could be traced, leaf mines recorded by Emmet & Plant 31.viii.1997.

***Parornix scoticella* (Stainton, 1850)**
First recorded 14.vii.1967, leaf mines recorded by Emmet & Plant 31.viii.1997.

***Callisto denticulella* (Thunberg, 1794)**
First recorded in the kitchen garden, 18.vi.1986, leaf mines recorded by Emmet & Plant 31.viii.1997.

***Acrocercops brongniardella* (Fabricius, 1798)**
13.vi.1996, mines on *Quercus.*

* ***Phyllonorycter harrisella* (Linnaeus, 1761)**
Several records at m.v., also leaf mines.

***Phyllonorycter heegeriella* (Zeller, 1846)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

* ***Phyllonorycter messaniella* (Zeller, 1846)**
Common.

***Phyllonorycter platani* (Staudinger, 1870)**
First recorded 3.viii.1995 at m.v.; leaf mines subsequently recorded by Emmet & Plant 31.viii.1997.

* ***Phyllonorycter oxyacanthae* (Frey, 1856)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

* ***Phyllonorycter blancardella* (Fabricius, 1781)**
Recorded from the kitchen garden by Bradley between 1965 and 1989, but no additional data could be traced, ?leaf mines recorded by Emmet & Plant 31.viii.1997 [possibly *Phyllonorycter cydoniella* (Denis &Schiffermüller 1775)].

* *Phyllonorycter spinicolella* (Zeller, 1846)

* ***Phyllonorycter corylifoliella* (Hübner, 1796)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

***Phyllonorycter leucographella* (Zeller, 1850)**, Firethorn Leaf Miner
Mines first recorded by Bradley in 1990. Halstead also recorded mines on *Pyrracantha* during the current survey period.

* ***Phyllonorycter maestingella* (Müller, 1764)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

***Phyllonorycter coryli* (Nicelli, 1851)**, Nut Leaf Blister Moth
Recorded by Bradley between 1965 and 1989, but no further data could be traced. Leaf mines recorded by Emmet & Plant 31.viii.1997.

* *Phyllonorycter rajella* (Linnaeus, 1758)
Leaf mines on Alders (*Alnus glutinosa*) by the lake.

* *Phyllonorycter tristrigella* (Haworth, 1828)

***Phyllonorycter stettinensis* (Nicelli, 1852)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Phyllonorycter froelichiella* (Zeller, 1839)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Phyllonorycter nicellii* (Stainton, 1851)**
Recorded by Bradley between 1965 and 1989 but no further data could be traced, leaf mines recorded by Emmet & Plant 31.viii.1997.

** ***Phyllonorycter kleemannella* (Fabricius, 1781)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

Phyllonorycter trifasciella (Haworth, 1828)
First recorded 9.viii.1974.

***Phyllonorycter platanoidella* (Joannis, 1920)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Phyllonorycter geniculella* (Ragonot, 1874)**
First recorded 16.vii.1982, leaf mines recorded by Emmet & Plant 31.viii.1997.

Phyllocnistis unipunctella (Stephens, 1834)
First recorded 22.viii.1979.

SESIIDAE

Synanthedon tipuliformis (Clerck, 1759), Currant Clearwing
Recorded vii.1976.

***Synanthedon vespiformis* (Linnaeus, 1761)**, Yellow-legged Clearwing
One specimen in Malaise trap 7-20.v.1995, first record.

Synanthedon myopaeformis (Borkhausen, 1789), Red-belted Clearwing
Recorded by Bradley on cultivated Apple (*Malus sylvestris*) in the kitchen garden between 1965 and 1989.

GLYPHIPTERIGIDAE

Glyphipterix simpliciella (Stephens, 1834), Cocksfoot Moth
First recorded 11.v.1989; signs of emergence holes believed to belong to this species had been found in Cock's Foot, *Dactylis glomerata*, stems in previous years.

ARGYRESTHIIDAE

Argyresthia ivella (Haworth, 1828)
First recorded 6.vii.1966.

* *Argyresthia brockeella* (Hübner, 1813)

* ***Argyresthia goedartella* (Linnaeus, 1758)**

* *Argyresthia pygmaeella* (Denis & Schiffermüller, 1775)

***Argyresthia curvella* (Linnaeus, 1761)**
First recorded by Bradley between 1965 and 1989.

* ***Argyresthia retinella* Zeller, 1839**

* *Argyresthia spinosella* Stainton, 1849

Argyresthia semifusca (Haworth, 1828)
Recorded 4.iv.1987.

* ***Argyresthia pruniella* (Clerck, 1759)**, Cherry Fruit Moth

Argyresthia bonnetella (Linnaeus, 1758)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Argyresthia albistria* (Haworth, 1828)

YPONOMEUTIDAE

* ***Yponomeuta evonymella* (Linnaeus, 1758)**, Bird-cherry Ermine

* *Yponomeuta padella* (Linnaeus, 1758), Orchard Ermine

* ***Yponomeuta cagnagella* (Hübner, 1813)**, Spindle Ermine

* *Swammerdamia pyrella* (Villers, 1789)

* *Paraswammerdamia lutarea* (Haworth, 1828)

* ***Prays fraxinella* (Bjerkander, 1784)**, Ash Bud Moth

Scythropia crataegella (Linnaeus, 1767), Hawthorn Moth
First recorded 23.vi.1976.

Ypsolopha dentella (Fabricius, 1775), Honeysuckle Moth
First recorded 18.vii.1967.

* ***Ypsolopha scabrella* (Linnaeus, 1761)**

Ypsolopha horridella (Treitschke, 1835)
First recorded 18.vii.1967.

Ypsolopha sylvella (Linnaeus, 1767)
Recorded 24.viii.1978.

***Ypsolopha ustella* (Clerck, 1759)**
Recorded 13.vii.2001.

* ***Ypsolopha sequella* (Clerck, 1759)**

* *Ypsolopha vittella* (Linnaeus, 1758)

* ***Plutella xylostella* (Linnaeus, 1758)**, Diamond-back Moth
This common migrant comes to m.v. every year, sometimes in large numbers.

* ***Eidophasia messingiella* (Fischer von Röslerstamm, 1840)**

***Digitivalva perlepidella* (Stainton, 1849)**
Recorded 27.vi.1996, first Middlesex record.

LYONETIIDAE

* ***Leucoptera laburnella* (Stainton, 1851)**, Laburnum Leaf Miner

* ***Lyonetia clerkella* (Linnaeus, 1758)**, Apple Leaf Miner

Bedellia somnulentella (Zeller, 1847)
Recorded 12.ix.1979

COLEOPHORIDAE

* ***Coleophora lutipennella* (Zeller, 1838)**

* *Coleophora serratella* (Linnaeus, 1761)

Coleophora spinella (Schrank, 1802), Apple & Plum Case-bearer
First recorded 2.viii.1974

* *Coleophora badiipennella* (Duponchel, 1843)

* *Coleophora limosipennella* (Duponchel, 1843)

Coleophora trifolii (Curtis, 1832)
First recorded 22.vi.1973

Coleophora mayrella (Hübner, 1813)
First recorded 20.vii.1971

Coleophora lineolea (Haworth, 1828)
Recorded 17.vi.1976

Coleophora hemerobiella (Scopoli, 1763)
First recorded 9.viii.1974

Coleophora laricella (Hübner, 1817), Larch Case-bearer
Recorded 17.vi.1981

* *Coleophora albidella* (Denis & Schiffermüller, 1775)

* *Coleophora ibipennella* Zeller, 1849

Coleophora albicosta (Haworth, 1828)
Recorded 6.vi.1966

* *Coleophora follicularis* (Vallot, 1802)

Coleophora trochilella (Duponchel, 1843)
First recorded 18.viii.1961

** ***Coleophora peribenanderi* Toll, 1943**

* *Coleophora sternipennella* (Zetterstedt, 1839)

Coleophora versurella Zeller, 1849
First recorded 22.vi.1973.

* *Coleophora artemisicolella* Bruand, 1855

Coleophora taeniipennella Herrich-Schäffer, 1855
Recorded by Bradley between 1965 and 1989 but no further data could be traced. First Middlesex record.

Coleophora glaucicolella Wood, 1892
First recorded 10.vii.1970.

Coleophora tamesis Waters, 1929
Recorded 2.vii.1971.

* ***Coleophora alticolella* Zeller, 1849**

Coleophora caespititiella Zeller, 1839
Recorded 15.vi.1976.

Coleophora clypeiferella Hofmann, 1871
Recorded 9.viii.1967.

ELACHISTIDAE

* *Elachista atricomella* Stainton, 1849

Elachista luticomella Zeller, 1839
First recorded 28.vi.1968.

* ***Elachista canapennella* (Hübner, 1813)**

* *Elachista rufocinerea* (Haworth, 1828)

Elachista maculicerusella Bruand, 1859
Recorded 3.vi.1970.

OECOPHORIDAE

***Batia lunaris* (Haworth, 1828)**
First recorded 29.vi.1983.

* ***Batia unitella* (Hübner, 1796)**

* ***Hofmannophila pseudospretella* (Stainton, 1849)**, Brown House-moth.
Frequent at m.v.

* ***Endrosis sarcitrella* (Linnaeus, 1758)**, White-shouldered House-moth

* ***Esperia sulphurella* (Fabricius, 1775)**

* ***Carcina quercana* (Fabricius, 1775)**
Occurs regularly at m.v. from June to August.

* *Diurnea fagella* (Denis & Schiffermüller, 1775)

* ***Depressaria daucella* (Denis & Schiffermüller, 1775)**

***Agonopteryx heracliana* (Linnaeus, 1758)**
First recorded 14.x.1966.

***Agonopterix alstromeriana* (Clerck, 1759)**
First recorded 22.x.1976.

* ***Agonopterix nervosa* (Haworth, 1811)**

GELECHIIDAE

Isophrictis striatella (Denis & Schiffermüller, 1775)
Recorded 22.viii.1978.

* *Monochroa hornigi* (Staudinger, 1883)
First published record as new to Britain (Bradley & Mere 1964) was of a specimen taken vi.1963, although subsequently a specimen taken in the garden two years earlier (vi.1961) was also found to belong to this species. Further specimens were recorded in 1984 and 1987.

Chrysoesthia sexguttella (Thunberg, 1794)
Recorded 20.v.1970.

Bryotropha affinis (Haworth, 1828)
First recorded 4.vii.1965.

* *Bryotropha similis* (Stainton, 1854)

Bryotropha senectella (Zeller, 1839)
First recorded 21.vii.1969.

* ***Bryotropha terrella* (Denis & Schiffermüller, 1775)**

***Bryotropha domestica* (Haworth, 1828)**
First recorded 18.ix.1978.

* ***Parachronistis albiceps* (Zeller, 1839)**

* *Recurvaria nanella* (Denis & Schiffermüller, 1775)

Athrips mouffetella (Linnaeus, 1758)
Recorded 25.vii.1975.

* *Teleiodes vulgella* (Denis & Schiffermüller, 1775)

***Teleiodes luculella* (Hübner, 1813)**
Recorded vii.1996.

***Carpatolechia alburnella* (Zeller, 1839)**
First recorded 8.viii.1975.

* *Carpatolechia fugitivella* (Zeller, 1839)

* *Mirificarma mulinella*, (Zeller, 1839)

Aroga velocella (Zeller, 1839)
Recorded 16.vii.1976.

Gelechia rhombella (Denis & Schiffermüller, 1775)
First recorded 27.vi.1966.

***Gelechia senticetella* (Staudinger, 1859)**
Recorded 16.viii.2001
* *Gelechia soroculella* (Hübner, 1817)
* ***Gelechia turpella* (Denis & Schiffermüller, 1775)**
Scrobipalpa ocellatella (Boyd, 1858), Beet Moth
Recorded 11.viii.1975.
* *Scrobipalpa obsoletella* (Fischer von Röslerstamm, 1841)
* *Scrobipalpa atriplicella* (Fischer von Röslerstamm, 1841)
* *Scrobipalpa costella* (Humphreys & Westwood, 1845)
Scrobipalpa acuminatella (Sircom, 1850)
Recorded 26.vii.1967.
* *Caryocolum fraternella* (Douglas, 1851)
* ***Caryocolum proximum* (Haworth, 1828)**
13.vi.1996 larvae in spun florets of Common Chickweed (*Stellaria media*).
** *Sophronia semicostella* (Hübner, 1813)
* *Aproaerema anthyllidella* (Hübner, 1813)
***Anacampsis populella* (Clerck, 1759)**
Recorded 28.vii.1995.
Anarsia spartiella (Schrank, 1802)
Recorded 24.vii.1972.
***Dichomeris marginella* (Fabricius, 1781)**, Juniper Webber
First recorded 23.vii.1969.
* *Brachmia blandella* (Fabricius, 1798)
* ***Helcystogramma rufescens* (Haworth, 1828)**
* *Pexicopia malvella* (Hübner, 1805), Hollyhock Seed Moth
* ***Oegoconia quadripuncta* (Haworth, 1828)**
***Oegoconia deauratella* (Herrich Schäffer, 1854)**
Recorded 20.vii.1995.

BLASTOBASIDAE

* ***Blastobasis lignea* Walsingham, 1894**
Extremely common in July and August, sometimes occurring in very large numbers.
***Blastobasis decolorella* (Wollaston, 1858)**
First recorded 18.vi.1969, now very common.

BATRACHEDRIDAE

* *Batrachedra praeangusta* (Haworth, 1828)

MOMPHIDAE

* *Mompha raschkiella* (Zeller, 1839)
Mompha propinquella (Stainton, 1851)
Recorded 7.vii.1982.
* *Mompha divisella* Herrich-Schäffer, 1854
Mompha sturnipennella (Treitschke, 1833)
First recorded 2.viii.1974.
***Mompha subbistrigella* (Haworth, 1828)**
First recorded 20.viii.1976.
* *Mompha epilobiella* (Denis & Schiffermüller, 1775)

COSMOPTERIGIDAE

* *Blastodacna atra* (Haworth, 1828), Apple Pith Moth
Sorhagenia lophyrella (Douglas, 1846)
Recorded 16.vii.1976. First Middlesex record.

TORTRICIDAE

* ***Agapeta hamana* (Linnaeus, 1758)**
Aethes hartmanniana (Clerck, 1759)
Recorded 18.vi.1971.
Aethes rubigana (Treitschke, 1830)
Recorded 13.vii.1983.

* *Aethes smeathmanniana* (Fabricius, 1781)
Eupoecilia angustana (Hübner, 1799)
Recorded 14.viii.1981.
Cochylidia implicitana (Wocke, 1856)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.
Falseuncaria ruficiliana (Haworth, 1811)
Recorded 17.viii.1981. First Middlesex record.
* *Cochylis dubitana* (Hübner, 1799)
Cochylis hybridella (Hübner, 1813)
Recorded 1.vii.1986.
***Cochylis nana* (Haworth, 1811)**
First recorded 3.vi.1970.
***Pandemis corylana* (Fabricius, 1794)**, Chequered Fruit-tree Tortrix
First recorded 8.viii.1975.
* ***Pandemis cerasana* (Hübner, 1786)**, Barred Fruit-tree Tortrix
* ***Pandemis heparana* (Denis & Schiffermüller, 1775)**, Dark Fruit-tree Tortrix
Argyrotaenia ljungiana (Thunberg, 1797)
Recorded 18.viii.1988.
* ***Archips podana* (Scopoli, 1763)**, Large Fruit-tree Tortrix
* ***Archips crataegana* (Hübner, 1799)**, Brown Oak Tortrix
* ***Archips xylosteana* (Linnaeus, 1758)**, Variegated Golden Tortrix
***Archips rosana* (Linnaeus, 1758)**, Rose Tortrix
First recorded by Bradley between 1965 and 1989.
* ***Cacoecimorpha pronubana* (Hübner, 1799)**, Carnation Tortrix
Syndemis musculana (Hübner, 1799)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.
* *Ptycholomoides aeriferanus* (Herrich-Schäffer, 1851)
* *Clepsis spectrana* (Treitschke, 1830), Cyclamen Tortrix
* ***Clepsis consimilana* (Hübner, 1817)**
***Ephiphyas postvittana* (Walker, 1863)**, Light Brown Apple Moth
First recorded 18.v.1989, becoming very common from 1998.
Adoxophyes orana (Fischer von Röslerstamm, 1834)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.
* *Ptycholoma lecheana* (Linnaeus, 1758)
Lozotaeniodes formosanus (Geyer, 1830)
Recorded 27.vii.1981.
* *Capua vulgana* (Frölich, 1828)
***Ditula angustiorana* (Haworth, 1811)**, Red-barred Tortrix
First recorded 1.vii.1968, common in June and July.
* ***Pseudargyrotoza conwagana* (Fabricius, 1775)**
* *Cnephasia stephensiana* (Doubleday, 1849), Grey Tortrix
* ***Cnephasia asseclana* (Denis & Schiffermüller, 1775)**, Flax Tortrix
* *Cnephasia pasiuana* (Hübner, 1799)
The only Middlesex record. Recorded 26.vi.1964 confirmed by dissection.
* *Cnephasia incertana* (Treitschke, 1835), Light Grey Tortrix
Eana osseana (Scopoli, 1763)
Recorded 17.vii.1967. First Middlesex record.
Eana incanana (Stephens, 1852).
Recorded 24.vii.1972.
* ***Aleimma loeflingiana* (Linnaeus, 1758)**
* ***Tortrix viridana* (Linnaeus, 1758)**, Green Oak Tortrix
Common in June and July.
* ***Acleris forsskaleana* (Linnaeus, 1758)**
Very common in June and July.
Acleris laterana (Fabricius, 1794)
Recorded 5.x.1979.
* ***Acleris sparsana* (Denis & Schiffermüller, 1775)**
Acleris rhombana (Denis & Schiffermüller, 1775), Rhomboid Tortrix
15.x.1969.

* *Acleris aspersana* (Hübner, 1817)
* *Acleris notana* (Donovan, 1806)
* ***Acleris variegana* (Denis & Schiffermüller, 1775)**, Garden Rose Tortrix
***Acleris cristana* (Denis & Schiffermüller, 1775)**
First recorded 20.vii.1989 and subsequently 3.viii.1995, 18.ix.1997, 5.viii.1999.
* *Celypha striana* (Denis & Schiffermüller, 1775)
* *Olethrutes lacunana* (Denis & Schiffermüller, 1775)
* *Piniphila bifasciana* (Haworth, 1811)
Hedya pruniana (Hübner, 1799), Plum Tortrix
Recorded 11.vi.1973.
** *Hedya nubiferana* (Haworth, 1811), Marbled Orchard Tortrix
** *Hedya ochroleucana* (Frölich, 1828)
* *Apotomis betuletana* (Haworth, 1811)
Lobesia abscisana (Doubleday, 1849)
First recorded 14.vii.1967.
Lobesia littoralis (Humphreys & Westwood, 1845)
Recorded 17.vii.1989.
* *Bactra lancealana* (Hübner, 1799)
***Eudemis profundana* (Denis & Schiffermüller, 1775)**
First recorded 13.vii.1979.
Ancylis achatana (Denis & Schiffermüller, 1775)
Recorded 1.vii.1966.
* *Ancylis badiana* (Denis & Schiffermüller, 1775)
Epinotia subocellana (Donovan, 1806)
Recorded 25.vii.1983.
* ***Epinotia bilunana* (Haworth, 1811)**
Epinotia demarniana (Fischer von Röslerstamm, 1840)
Recorded 12.vi.1970.
* ***Epinotia immundana* (Fischer von Röslerstamm, 1839)**
* ***Epinotia nisella* (Clerck, 1759)**
***Epinotia tenerana* (Denis & Schiffermüller, 1775)**, Nut Bud Moth
Recorded 16.vii.1997.
Epinotia tedella (Clerck, 1759)
Recorded 20.vi.1984.
* ***Epinotia abbreviana* (Fabricius, 1794)**
* *Epinotia brunnichana* (Linnaeus, 1767)
* *Epinotia solandriana* (Linnaeus, 1758)
* ***Rhopobota naevana* (Hübner, 1817)**, Holly Tortrix
* ***Zeiraphera isertana* (Fabricius, 1794)**
(Erroneously listed as *incertana* by Bradley & Mere 1964)
* *Zeiraphera griseana* (Hübner, 1799), Larch Tortrix.
First Middlesex record.
* ***Gypsonoma aceriana* (Duponchel, 1843)**
* ***Gypsonoma sociana* (Haworth, 1811)**
* ***Gypsonoma dealbana* (Frölich, 1828)**
***Gypsonoma oppressana* (Treitschke, 1835)**
First recorded by Bradley between 1965 and 1989 but no further data could be traced.
***Gypsonoma minutana* (Hübner, 1799)**
Recorded 18.vii.1969.
* *Epiblema cynosbatella* (Linnaeus, 1758)
***Epiblema uddmanniana* (Linnaeus, 1758)**, Bramble Shoot Moth
First recorded 25.vi.1974.
Epiblema rosaecolana (Doubleday, 1850)
Recorded 3.vii.1973.
* *Epiblema foenella* (Linnaeus, 1758)
* ***Eucosma cana* (Haworth, 1811)**
* *Eucosma obumbratana* (Lienig & Zeller, 1846)
* ***Spilonota ocellana* (Denis & Schiffermüller, 1775)**, Bud Moth

Spilonota laricana (Heinemann, 1863)
First recorded 27.vii.1965.
* *Clavigesta purdeyi* (Durrant, 1911), Pine Leaf-mining Moth
* *Rhyacionia pinicolana* (Doubleday, 1849)
* *Rhyacionia pinivorana* (Lienig & Zeller, 1846), Spotted Shoot Moth
* ***Enarmonia formosana* (Scopoli, 1763)**, Cherry-bark Tortrix
Lathronympha strigana (Fabricius, 1775)
First recorded 19.vii.1964.
** *Pammene aurita* Razowski, 1991
* *Pammene regiana* (Zeller. 1849)
Pammene trauniana (Denis & Schiffermüller, 1775)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.
* ***Pammene fasciana* (Linnaeus, 1761)**
Pammene herrichiana (Heinemann, 1854)
Recorded 25.vii.1975.
** *Cydia succedana* (Denis & Schiffermüller, 1775)
* ***Cydia fagiglandana* (Zeller, 1841)**
* ***Cydia splendana* (Hübner, 1799)**
* ***Cydia pomonella* (Linnaeus, 1758)**, Codling Moth
Recorded every year in small numbers.
***Dichrorampha alpinana* (Treitschke, 1830)**
Recorded 8.vi.1995.
* *Dichrorampha simpliciana* (Haworth, 1811)

PYRALIDAE

* ***Chrysoteuchia culmella* (Linnaeus, 1758)**
Common in June and July.
* ***Crambus pascuella* (Linnaeus, 1758)**
Common.
* ***Crambus lathoniellus* (Zincken, 1817)**
* *Crambus perlella* (Scopoli, 1763)
* ***Agriphila straminella* (Denis & Schiffermüller, 1775)**
* ***Agriphila tristella* (Denis & Schiffermüller, 1775)**
Common in June and July.
* *Agriphila inquinatella* (Denis & Schiffermüller, 1775)
* ***Agriphila geniculea* (Haworth, 1811)**
Common in August.
Catoptria pinella (Linnaeus, 1758)
First recorded 22.vii.1970.
* *Pediasia contaminella* (Hübner, 1796)
***Platytes alpinella* (Hübner, 1813)**
Recorded 3.viii.1995, first Middlesex record.
Donacaula forficella (Thunberg, 1794)
Recorded 18.vii.1969.
* *Donacaula mucronellus* (Denis & Schiffermüller, 1775)
Scoparia subfusca (Haworth, 1811)
Recorded 18.v.1989.
* ***Scoparia pyralella* (Denis & Schiffermüller, 1775)**
* *Scoparia ambigualis* (Treitschke, 1829)
* ***Eudonia truncicolella* (Stainton, 1849)**
***Eudonia angustea* (Curtis, 1827)**
Recorded 13.ix.2001
* ***Eudonia mercurella* (Linnaeus, 1758)**
Very common from June-August.
* *Acentria ephemerella* (Denis & Schiffermüller, 1775), Water Veneer
* *Elophila nymphaeata* (Linnaeus, 1758), Brown China-mark
Cataclysta lemnata (Linnaeus, 1758), Small China-mark
Recorded 5.viii.1987.

* ***Evergestis forficalis* (Linnaeus, 1758)**, Garden Pebble

Evergestis extimalis (Scopoli, 1763)
First recorded 10.viii.1981.

* ***Pyrausta aurata* (Scopoli, 1763)**

Pyrausta purpuralis (Linnaeus, 1758)
Recorded 21.vii.1982.

** ***Sitochroa verticalis* (Linnaeus, 1758)**

* ***Ostrinia nubilalis* (Hübner, 1796)**, European Corn-borer

* *Eurrhypara hortulata* (Linnaeus, 1758), Small Magpie

***Phlyctaenia coronata* (Hufnagel, 1767)**
First recorded 4.vii.1969.

* *Udea lutealis* (Hübner, 1809)

***Udea olivalis* (Denis & Schiffermüller, 1775)**
Recorded 15.vi.1995.

* *Udea ferrugalis* (Hübner, 1796), Rusty-dot Pearl.

* ***Nomophila noctuella* (Denis & Schiffermüller, 1775)**, Rush Veneer
This migrant occasionally recorded in large numbers.

Maruca vitrata (Fabricius, 1787), Mung Moth
Recorded 2.vii.1992.

* ***Pleuroptya ruralis* (Scopoli, 1763)**, Mother of Pearl

* ***Hypsopygia costalis* (Fabricius, 1775)**, Gold Fringe or Gold Triangle
Very common from June-August.

***Orthopygia glaucinalis* (Linnaeus, 1758)**
Recorded 20.vii.1995.

* *Aglossa pinguinalis* (Linnaeus, 1758), Large Tabby

* ***Endotricha flammealis* (Denis & Schiffermüller, 1775)**
Frequent from June-August

***Achroia grisella* (Fabricius, 1794)**, Lesser Wax Moth
First recorded 17.vii.1989.

* ***Aphomia sociella* (Linnaeus, 1758)**, Bee Moth
Frequent in June and July.

* ***Conobathra repandana* (Fabricius, 1798)**
Recorded incorrectly as *tumidana* (Denis & Schiffermüller, 1775) by Bradley & Mere, 1964.

***Trachycera suavella* (Zincken, 1818)**
Recorded 20.vii.1995.

***Trachycera advenella* (Zincken, 1818)**
First recorded 30.vii.1975.

* *Pempelia formosa* (Haworth, 1811)

** *Pyla fusca* (Haworth, 1811)

* ***Phycita roborella* (Denis & Schiffermüller, 1775)**

* *Myelois circumvoluta* (Geoffroy, 1785), Thistle Ermine

Apomyelois ceratoniae (Zeller, 1839), Locust Bean Moth
Recorded 6.vi.1980.

***Eccopisa effractella* (Zeller, 1848)**
Recorded 13.vii.1995 – new to Britain (Agassiz, 1996).

Ancylosis oblitella (Zeller, 1848)
Recorded 5.viii.1976.

Euzophera cinerosella (Zeller, 1839)
Recorded 30.vi.1970.

* ***Euzophera pinguis* (Haworth, 1811)**

Ephestia elutella (Hübner, 1796), Cacao Moth
Recorded 7.vii.1969

***Ephestia parasitella* (Staudinger, 1859)**
First recorded by Bradley between 1965 and 1989.

***Plodia interpunctella* (Hübner, 1813)**, Indian Meal Moth
Recorded 12.viii.1999.

Homoeosoma sinuella (Fabricius, 1794)
First recorded 23.vi.1976.

* *Phycitodes binaevella* (Hübner, 1813)

* *Phycitodes saxicola* (Vaughan, 1870)

PTEROPHORIDAE

* *Amblyptilia acanthadactyla* (Hübner, 1813)
New to Middlesex list.

Platyptilia ochrodactyla (Denis & Schiffermüller, 1775)
First recorded 9.viii.1967

Stenoptilia bipunctidactyla (Scopoli, 1763)
Recorded 11.ix.1975, first Middlesex record.

* *Pterophorus pentadactyla* (Linnaeus, 1758), White Plume Moth

***Emmelina monodactyla* (Linnaeus, 1758)**
First recorded 10.x.1975.

HESPERIIDAE

Ochlodes faunus (Turati, 1905), Large Skipper
Recorded 5.vii.1979.

Erynnis tages (Linnaeus, 1758), Dingy Skipper
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

PIERIDAE

Colias croceus (Geoffroy, 1785), Clouded Yellow
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Gonepteryx rhamni (Linnaeus, 1758), Brimstone
First recorded 18.ix.1968.

* ***Pieris brassicae* (Linnaeus, 1758)**, Large White

* ***Pieris rapae* (Linnaeus, 1758)**, Small White

Pieris napi (Linnaeus, 1758), Green-veined White
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Anthocharis cardamines (Linnaeus, 1758), Orange-tip
Recorded 13.v.1980.

LYCAENIDAE

Neozephyrus quercus (Linnaeus, 1758), Purple Hairstreak
Recorded 25.vii.1983.

Lycaena phlaeas (Linnaeus, 1761), Small Copper
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Lycaena dispar (Haworth, 1803), Large Copper
3.viii.1977, trial release; see discussion.

Polyommatus icarus (Rottemburg, 1775), Common Blue
Recorded 22.viii.1983.

* ***Celastrina argiolus* (Linnaeus, 1758)**, Holly Blue
Became very common in 1989 and has maintained good numbers since.

NYMPHALIDAE

* ***Vanessa atalanta* (Linnaeus, 1758)**, Red Admiral
Several observations on *Buddleja* and in the herbaceous border.

***Cynthia cardui* (Linnaeus, 1758)**, Painted Lady
First recorded 12.ix.1966.

* ***Aglais urticae* (Linnaeus, 1758)**, Small Tortoiseshell
Several observations on *Buddleja* and in the herbaceous border.

***Inachis io* (Linnaeus, 1758)**, Peacock
First recorded 6.vi.1975.

***Polygonia c-album* (Linnaeus, 1758)**, Comma
First recorded 13.ix.1976.

***Pararge aegeria* (Linnaeus, 1758)**, Speckled Wood
First recorded 31.ix.1972, now very common in wooded areas of the garden.

Lasiommata megera (Linnaeus, 1767), Wall
Seen on two occasions by Bradley in the 1970s but no precise data could be traced.

***Pyronia tithonus* (Linnaeus, 1771)**, Hedge Brown or Gatekeeper
One specimen observed 15.viii.91 on Ragwort flowers on The Mound.

Maniola jurtina (Linnaeus, 1758), Meadow Brown
Seen occasionally by Bradley between 1965 and 19819 but no precise data could be traced.

Coenonympha pamphilus (Linnaeus, 1758), Small Heath
Seen rarely by Bradley between 1965 and 1989, but no precise data could be traced.

DREPANIDAE

Falcaria lacertinaria (Linnaeus, 1758), Scalloped Hook-tip
Recorded 27.vii.1967.

* ***Watsonalla binaria* (Hufnagel, 1767)**, Oak Hook-tip

* *Cilix glaucata* (Scopoli, 1763), Chinese Character

THYATIRIDAE

* ***Tethea ocularis* (Linnaeus, 1767)**, Figure of Eighty
Numerous records since 1995.

GEOMETRIDAE

***Alsophila aescularia* (Denis & Schiffermüller, 1775)**, March Moth
Recorded 13.iii.1997.

***Hemithea aestivaria* (Hübner, 1799)**, Common Emerald
First recorded 2.vii.1975.

Cyclophora punctaria (Linnaeus, 1758), Maiden's Blush,
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Timandra comae* (Schmidt, 1931), Blood-vein

* *Scopula marginepunctata* (Goeze, 1781), Mullein Wave

***Idaea rusticata* (Denis & Schiffermüller, 1775)**, Least Carpet
Recorded 31.vii.1981.

* ***Idaea seriata* (Schrank, 1802)**, Small Dusty Wave

* ***Idaea aversata* (Linnaeus, 1758)**, Riband Wave
Very common in June and July.

Idaea straminata (Borkhausen, 1794), Plain Wave
Recorded by Bradley in 1971 (Plant, 1993:35).

Rhodometra sacraria (Linnaeus, 1767), Vestal
Recorded 5-10.v.1983.

* *Orthonama obstipata* (Fabricius, 1794), Gem

* *Xanthorhoe spadicearia* (Denis & Schiffermüller, 1775), Red Twin-spot Carpet

* *Xanthorhoe ferrugata* (Clerck, 1759), Dark-barred Twin-spot Carpet

** *Xanthorhoe montanata* (Denis & Schiffermüller, 1775), Silver-ground Carpet

* ***Xanthorhoe fluctuata* (Linnaeus, 1758)**, Garden Carpet
Common.

* *Epirrhoe alternata* (Müller, 1764), Common Carpet

* *Camptogramma bilineata* (Linnaeus, 1758), Yellow Shell

* *Pelurga comitata* (Linnaeus, 1758), Dark Spinach

***Eulithis prunata* (Linnaeus, 1758)**, Phoenix
Recorded 26.vii.2001.

* *Eulithis mellinata* (Fabricius, 1787), Spinach

* *Ecliptopera silaceata* (Denis & Schiffermüller, 1775), Small Phoenix

***Chloroclysta siterata* (Hufnagel, 1767)**, Red-green Carpet
Recorded 1.x1998. An extremely scarce and local resident in London (Plant, 1993), though now undergoing an expansion of range (Plant, 1999).

***Chloroclysta citrata* (Linnaeus, 1761)**, Dark Marbled Carpet
Recorded 13.vi.1996. Plant (1993) records this as a widespread but very local resident in London.

* ***Chloroclysta truncata* (Hufnagel, 1767)**, Common Marbled Carpet,
Recorded every year, usually dark forms.

Plemyria rubiginata (Denis & Schiffermüller, 1775), Blue-bordered Carpet
Recorded 13.vii.1970.

* ***Thera obeliscata* (Hübner, 1787)**, Grey Pine Carpet
Numerous records since 1995.

* ***Hydriomena furcata* (Thunberg, 1784)**, July Highflyer

Hydriomena impluviata (Denis & Schiffermüller, 1775), May Highflyer
Recorded 16.vi.1966.

** *Triphosa dubitata* (Linnaeus, 1758), Tissue

** *Philereme vetulata* (Denis & Schiffermüller, 1775), Brown Scallop

Philereme transversata (Hufnagel, 1767), Dark Umber
Recorded 3.vii.1973.

Euphyia biangulata (Haworth, 1809), Cloaked Carpet,
Recorded by Bradley between 1965 and 1989 but no further data could be traced. First Middlesex record.

Euphyia unangulata (Haworth, 1809), Sharp-angled Carpet
Recorded 22.vii.1970.

* *Epirrita dilutata* (Denis & Schiffermüller, 1775)
November Moth

* *Operophtera brumata* (Linnaeus, 1758), Winter Moth

* *Perizoma alchemillata* (Linnaeus, 1758), Small Rivulet

Eupithecia inturbata (Hübner, 1817), Maple Pug
Recorded 8.viii.1975.

* ***Eupithecia linariata* (Denis & Schiffermüller, 1775)**, Toadflax Pug

* *Eupithecia pulchellata* Stephens, 1831, Foxglove Pug

***Eupithecia exiguata* (Hübner, 1813)**, Mottled Pug
First recorded 20.v.1982.

* ***Eupithecia centaureata* (Denis & Schiffermüller, 1775)**, Lime-speck Pug

Eupithecia intricata (Zetterstedt, 1839), Freyer's Pug
Recorded 7.vi.1984.

Eupithecia absinthiata (Clerck, 1759), Wormwood Pug
Recorded 8.vii.1966.

* ***Eupithecia vulgata* (Haworth, 1809)**, Common Pug

* *Eupithecia icterata* (Villers, 1789), Tawny Speckled Pug

* *Eupithecia succenturiata* (Linnaeus, 1758), Bordered Pug

Eupithecia millefoliata Rössler, 1866, Yarrow Pug,
Recorded by Bradley in 1974 (Plant, 1993).

Eupithecia simpliciata (Haworth, 1809), Plain Pug
Recorded 26.vii.1974.

Eupithecia nanata (Hübner, 1813), Narrow-winged Pug
Recorded 13.vii.1973.

Eupithecia innotata f. *fraxinata* Crewe, 1863, Ash Pug
Recorded 8.vi.1973.

* *Eupithecia abbreviata* Stephens, 1831, Brindled Pug

Eupithecia dodoneata Guenée, 1857, Oak-tree Pug
Recorded 21.v.1973.

* *Eupithecia lariciata* (Freyer, 1842), Larch Pug

* ***Pasiphila rectangulata* (Linnaeus, 1758)**, Green Pug
Common, usually melanic.

* ***Gymnoscelis rufifasciata* (Haworth, 1809)**, Double-striped Pug
Quite common.

Chesias legatella (Denis & Schiffermüller, 1775), Streak
Recorded 13.x1967. A very local and uncommon resident in London (Plant 1993).

Aplocera plagiata (Linnaeus, 1758), Treble-bar
Recorded 23.ix.1981.

* ***Aplocera efformata* (Guenée, 1857)**, Lesser Treble-bar

* *Acasis viretata* (Hübner, 1799), Yellow-barred Brindle

* *Abraxas grossulariata* (Linnaeus, 1758), Magpie

Macaria liturata (Clerck, 1759), Tawny-barred Angle
Recorded 21.v.1985.

* *Macaria wauaria* (Linnaeus, 1758), V-moth

** *Chiasmia clathrata* (Linnaeus, 1758), Latticed Heath

Petrophora chlorosata (Scopoli, 1763), Brown Silver-line
Recorded 7.vi.1968.

* ***Opisthograptis luteolata* (Linnaeus, 1758)**, Brimstone Moth
A few specimens every year.

Apeira syringaria (Linnaeus, 1758), Lilac Beauty
Recorded 29.vi.1989.

* *Ennomos quercinaria* (Hufnagel, 1767), August Thorn

***Ennomos alniaria* (Linnaeus, 1758)**, Canary-shouldered Thorn
Recorded 8.viii.1996.

* *Ennomos fuscantaria* (Haworth, 1809), Dusky Thorn

* *Odontopera bidentata* (Clerck, 1759), Scalloped Hazel

* ***Crocallis elinguaria* (Linnaeus, 1758)**, Scalloped Oak

* ***Ourapteryx sambucaria* (Linnaeus, 1758)**, Swallow-tailed Moth

* ***Colotois pennaria* (Linnaeus, 1761)**, Feathered Thorn

* ***Lycia hirtaria* (Clerck, 1759)**, Brindled Beauty

* ***Biston betularia* (Linnaeus, 1758)**, Peppered Moth

* *Agriopis aurantiaria* (Hübner, 1799), Scarce Umber

** *Agriopis marginaria* (Fabricius, 1777), Dotted Border

***Erannis defoliaria* (Clerck, 1759)**, Mottled Umber
First recorded 21.x.1966.

Menophra abruptaria (Thunberg, 1792), Waved Umber
First recorded 7.vi.1972.

* ***Peribatodes rhomboidaria* (Denis & Schiffermüller, 1775)**, Willow Beauty
Very common in most years.

***Alcis repandata* (Linnaeus, 1758)**, Mottled Beauty
Recorded 6.vii.2001.

Aethalura punctulata (Denis & Schiffermüller, 1775), Grey Birch
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

* *Cabera pusaria* (Linnaeus, 1758), Common White Wave

Cabera exanthemata (Scopoli, 1763), Common Wave
Recorded 8.vi.1970.

Lomographa bimaculata (Fabricius, 1775), White-pinion Spotted
Recorded 20.v.1982.

***Lomographa temerata* (Denis & Schiffermüller, 1775)**, Clouded Silver
First recorded 16.vi.1984.

***Campaea margaritata* (Linnaeus, 1767)**, Light Emerald
First recorded 27.vi.1973, now a few specimens every year.

***Hylaea fasciaria* (Linnaeus, 1758)**, Barred Red
Recorded 13.vii.2001.

SPHINGIDAE

* *Sphinx ligustri* (Linnaeus, 1758), Privet Hawk-moth

* ***Mimas tiliae* (Linnaeus, 1758)**, Lime Hawk-moth
A few every year.

Smerinthus ocellata (Linnaeus, 1758), Eyed Hawk-moth
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

* ***Laothoe populi* (Linnaeus, 1758)**, Poplar Hawk-moth
A few every year.

Macroglossum stellatarum (Linnaeus, 1758), Humming-bird Hawk-moth
Seen by Bradley and the palace gardeners on several occasions between 1965 and 1989 but no precise data could be traced.

Deilephila elpenor (Linnaeus, 1758), Elephant Hawk-moth
Recorded 16.vi.1970.

NOTODONTIDAE

Cerura vinula (Linnaeus, 1758), Puss Moth
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Furcula bifida **(Brahm, 1787)**, Poplar Kitten
First recorded 9.vii.1971.

Pheosia tremula **(Clerck, 1759)**, Swallow Prominent
First recorded 7.vii.1967.

* *Phalera bucephala* (Linnaeus, 1758), Buff-tip

LYMANTRIIDAE

* ***Orgyia antiqua*** **(Linnaeus, 1758)**, Vapourer

Euproctis chrysorrhoea **(Linnaeus, 1758)**, Brown-tail
First recorded 14.vii.1967 (Bradley,1984), now a few specimens recorded each year.

* ***Leucoma salicis*** **(Linnaeus, 1758)**, White Satin Moth

Lymantria monacha **(Linnaeus, 1758)**, Black Arches
Recorded 8.viii.1996. A noteworthy record at the time, although this species subsequently appeared in a number of garden light traps in London during 1997 and 1998 (Plant, 1999).

ARCTIIDAE

** *Eilema complana* (Linnaeus 1758), Scarce Footman

Eilema depressa **(Esper, 1787)**, Buff Footman
Recorded 2.viii.2001.

* *Eilema lurideola* (Zincken, 1817), Common Footman

* ***Arctia caja*** **(Linnaeus, 1758)**, Garden Tiger

* ***Spilosoma lubricipeda*** **(Linnaeus, 1758)**, White Ermine

* *Spilosoma luteum* (Hufnagel, 1766), Buff Ermine

* *Diaphora mendica* (Clerck, 1759), Muslin Moth

* *Phragmatobia fuliginosa* (Linnaeus, 1758), Ruby Tiger

* *Tyria jacobaeae* (Linnaeus, 1758), Cinnabar

NOLIDAE

Nola cucullatella (Linnaeus, 1758), Short-cloaked Moth
First recorded 4.vii.1969.

NOCTUIDAE

* ***Agrotis segetum*** **(Denis & Schiffermüller, 1775)**, Turnip Moth
Recorded every year.

Agrotis clavis **(Hufnagel, 1766)**, Heart & Club
Recorded 28.vii.1995.

* ***Agrotis exclamationis*** **(Linnaeus, 1758)**, Heart & Dart
Very common.

* ***Agrotis ipsilon*** **(Hufnagel, 1766)**, Dark Sword-grass

* ***Agrotis puta*** **(Hübner, 1803)**, Shuttle-shaped Dart
Common.

* *Axylia putris* (Linnaeus, 1761), Flame

* ***Ochropleura plecta*** **(Linnaeus, 1761)**, Flame Shoulder

* ***Noctua pronuba*** **(Linnaeus, 1758)**, Large Yellow Underwing
Very common.

* ***Noctua comes*** **(Hübner, 1813)**, Lesser Yellow Underwing
Common.

* ***Noctua fimbriata*** **(Schreber, 1759)**, Broad-bordered Yellow Underwing

* ***Noctua janthe*** **(Borkhausen, 1792)**, Lesser Broad-bordered Yellow Underwing
Common

Noctua interjecta (Hübner, 1803), Least Yellow Underwing
Recorded 16.viii.1974.

* *Graphiphora augur* (Fabricius, 1775), Double Dart

Eugnorisma glareosa (Esper, 1788), Autumnal Rustic
Recorded 19.ix.1985. A very local species in London (Plant, 1993).

Lycophotia porphyrea (Denis & Schiffermüller, 1775), True Lover's Knot
First recorded 23.vii.1969.

* *Peridroma saucia* (Hübner, 1808), Pearly Underwing

* ***Diarsia rubi*** **(Vieweg, 1790)**, Small Square-spot
Common.

* ***Xestia c-nigrum* (Linnaeus, 1758)**, Setaceous Hebrew Character
A few specimens every year.

***Xestia triangulum* (Hufnagel, 1766)**, Double Square-spot
Recorded 18.vii.1996.

* ***Xestia xanthographa* (Denis & Schiffermüller, 1775)**, Square-spot Rustic
Common every year.

* *Discestra trifolii* (Hufnagel, 1766), Nutmeg

Hada plebeja (Linnaeus, 1761), Shears
First recorded 1.vii.1968.

Polia nebulosa (Hufnagel, 1766), Grey Arches
Recorded 9.vii.1992.

* ***Mamestra brassicae* (Linnaeus, 1758)**, Cabbage Moth

* *Melanchra persicariae* (Linnaeus, 1761), Dot Moth

* *Melanchra pisi* (Linnaeus, 1758), Broom Moth

* *Lacanobia thalassina* (Hufnagel, 1766), Pale-shouldered Brocade

* ***Lacanobia oleracea* (Linnaeus, 1758)**, Bright-line Brown-eye
A few every year.

* ***Hadena rivularis* (Fabricius, 1775)**, Campion

* *Hadena confusa* (Hufnagel, 1766), Marbled Coronet

* ***Hadena bicruris* (Hufnagel, 1766)**, Lychnis

* *Cerapteryx graminis* (Linnaeus, 1758), Antler Moth

Tholera cespitis (Denis & Schiffermüller, 1775), Hedge Rustic
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

***Orthosia cruda* (Denis & Schiffermüller, 1775)**, Small Quaker
First recorded 18.iv1996.

* ***Orthosia cerasi* (Fabricius, 1775)**, Common Quaker

* ***Orthosia incerta* (Hufnagel, 1766)**, Clouded Drab
Common.

***Orthosia munda* (Denis & Schiffermüller, 1775)**, Twin-spotted Quaker
First recorded by Bradley between 1965 and 1989.

* ***Orthosia gothica* (Linnaeus, 1758)**, Hebrew Character
Common.

* *Mythimna conigera* (Denis & Schiffermüller, 1775), Brown-line Bright-eye

* ***Mythimna ferrago* (Fabricius, 1787)**, Clay
A few every year.

* ***Mythimna impura* (Hübner, 1808)**, Smoky Wainscot
A few every year.

* ***Mythimna pallens* (Linnaeus, 1758)**, Common Wainscot
A few every year.

** *Mythimna comma* (Linnaeus, 1761), Shoulder-striped Wainscot

* *Cucullia absinthii* (Linnaeus, 1761), Wormwood

***Shargacucullia verbasci* (Linnaeus, 1758)**, Mullein
Larva noted on *Verbascum* in glasshouse in 1999, date not recorded. According to Plant (1993) this moth is rather local in London and is mainly confined to more rural areas.

* *Brachylomia viminalis* (Fabricius, 1777), Minor Shoulder-knot

Aporophyla lutulenta (Denis & Schiffermüller, 1775), Deep-brown Dart
Recorded 6.x.1978.

***Aporophyla nigra* (Haworth, 1809)**, Black Rustic
First recorded 4.x.1968.

Lithophane ornitopus (Hufnagel, 1766), Grey Shoulder-knot
Recorded 19.x.1989.

***Lithophane leautieri* (Boisduval, 1829)**, Blair's Shoulder-knot or Stone Pinion
First recorded 19.x.1989.

***Xylocampa areola* (Esper, 1789)**, Early Grey
First recorded 15.iv.1981.

** ***Eupsilia transversa* (Hufnagel, 1766)**, Satellite

** *Conistra vaccinii* (Linnaeus, 1761), Chestnut

* ***Agrochola circellaris* (Hufnagel, 1766)**, Brick

***Agrochola lota* (Clerck, 1759)**, Red-line Quaker
First recorded 8.x1998.

***Agrochola litura* (Linnaeus, 1761)**, Brown-spot Pinion
First recorded 19.ix.1986.

* *Agrochola lychnidis* (Denis & Schiffermüller, 1775), Beaded Chestnut

***Atethmia centrago* (Haworth, 1809)**, Centre-barred Sallow
First recorded 18.ix1997.

***Omphaloscelis lunosa* (Haworth, 1809)**, Lunar Underwing
First recorded 19.ix.1985.

Xanthia icteritia (Hufnagel, 1766), Sallow
Recorded 10.ix.1992

* ***Acronicta megacephala* (Denis & Schiffermüller, 1775)**, Poplar Grey

* ***Acronicta aceris* (Linnaeus, 1758)**, Sycamore

Acronicta leporina (Linnaeus, 1758), Miller
Recorded 22.vi.1989.

* ***Acronicta psi* (Linnaeus, 1758)**, Grey Dagger
Several records.

* ***Acronicta rumicis* (Linnaeus, 1758)**, Knot Grass

* ***Cryphia domestica* (Hufnagel, 1766)**, Marbled Beauty
Now common every year.

* ***Amphipyra pyramidea* (Linnaeus, 1758)**, Copper Underwing
Quite common every year.

***Amphipyra berbera* Rungs, 1949**, Svensson's Copper Underwing
First recorded 19.ix.1968.

* *Amphipyra tragopogonis* (Clerck, 1759), Mouse Moth

* ***Mormo maura* (Linnaeus, 1758)**, Old Lady
Common every year at m.v.; also found aestivating in the ice house and in the former hen house by The Lake.

* ***Dypterygia scabriuscula* (Linnaeus, 1758)**, Bird's Wing

* ***Thalpophila matura* (Hufnagel, 1766)**, Straw Underwing

* *Euplexia lucipara* (Linnaeus, 1758), Small Angle Shades

* ***Phlogophora meticulosa* (Linnaeus, 1758)**, Angle Shades
A few every year.

***Ipimorpha subtusa* (Denis & Schiffermüller, 1775)**, Olive
First recorded 4.viii.1987.

* ***Parastichtis suspecta* (Hübner, 1817)**, Suspected
Several records in July. A very local and uncommon London resident (Plant, 1993).

* *Parastichtis ypsillon* (Denis & Schiffermüller, 1775), Dingy Shears

* *Cosmia affinis* (Linnaeus, 1767), Lesser-spotted Pinion

* ***Cosmia trapezina* (Linnaeus, 1758)**, Dun-bar
Very common every year, sometimes occurring in large numbers.

* ***Apamea monoglypha* (Hufnagel, 1766)**, Dark Arches
Very common every year.

* ***Apamea lithoxylaea* (Denis & Schiffermüller, 1775)**, Light Arches

* *Apamea remissa* (Hübner, 1809), Dusky Brocade

** *Apamea anceps* (Denis & Schiffermüller, 1775), Large Nutmeg

* *Apamea sordens* (Hufnagel, 1766), Rustic Shoulder-knot

Apamea ophiogramma (Esper, 1793), Double Lobed
Recorded 22.vii.1970.

* ***Oligia strigilis* (Linnaeus, 1758)**, Marbled Minor

* ***Oligia latruncula* (Denis & Schiffermüller, 1775)**, Tawny Marbled Minor
Dark forms very common.

* *Oligia fasciuncula* (Haworth, 1809), Middle-barred Minor

* ***Mesoligia furuncula* (Denis & Schiffermüller, 1775)**, Cloaked Minor

* *Mesoligia literosa* (Haworth, 1809), Rosy Minor

* ***Mesapamea secalis* (Linnaeus, 1758)**, Common Rustic
Common.

***Mesapamea didyma* (Esper, 1788)**, Lesser Common Rustic
Recorded 3.viii.2001 (checked by dissection), but probably overlooked earlier.

* *Photedes minima* (Haworth, 1809), Small Dotted Buff

* *Chortodes pygmina* (Haworth, 1809), Small Wainscot

* ***Luperina testacea* (Denis & Schiffermüller, 1775)**, Flounced Rustic
Common.

* *Amphipoea oculea* (Linnaeus, 1761), Ear Moth

* *Hydraecia micacea* (Esper, 1789), Rosy Rustic

* *Celaena leucostigma* (Hübner, 1808), Crescent

* *Coenobia rufa* (Haworth, 1809), Small Rufous

***Charanyca trigrammica* (Hufnagel, 1766)**, Treble Lines
Recorded 1.vi.1995.

* ***Hoplodrina alsines* (Brahm, 1791)**, Uncertain

* ***Hoplodrina blanda* (Denis & Schiffermüller, 1775)**, Rustic

* ***Hoplodrina ambigua* (Denis & Schiffermüller, 1775)**, Vine's Rustic

* *Caradrina morpheus* (Hufnagel, 1766), Mottled Rustic

* ***Paradrina clavipalpis* (Scopoli, 1763)**, Pale Mottled Willow
Very common every year.

Protodeltote pygarga (Hufnagel, 1766), Marbled White Spot
Recorded 15.vi.1989.

Earias clorana (Linnaeus, 1761), Cream-bordered Green Pea
Recorded 7.vi.1968. An extremely local London resident (Plant, 1993).

* *Earias biplaga* (Walker, 1866), Spiny Bollworm
Recorded vii.1964 as new to Britain (Bradley & Mere, 1964).

***Bena bicolorana* (Fuessly, 1775)**, Scarce Silver-lines
First recorded 26.vi.1997.

***Nycteola revayana* (Scopoli, 1772)**, Oak Nycteoline
First recorded 9.vii.1986.

* *Diachrysia chrysitis* (Linnaeus, 1758), Burnished Brass

Polychrysia moneta (Fabricius, 1787), Golden Plusia
Recorded 6.vii.1973.

* ***Autographa gamma* (Linnaeus, 1758)**, Silver Y
Recorded every year, this common migrant sometimes occurs in large numbers.

* *Autographa pulchrina* (Haworth, 1809), Beautiful Golden Y

* *Abrostola triplasia* (Linnaeus, 1758), Dark Spectacle.
Extremely local and rare in London (Plant, 1993).

* ***Abrostola tripartita* (Hufnagel, 1766)**, Spectacle

* ***Catocala nupta* (Linnaeus, 1767)**, Red Underwing

Lygephila pastinum (Treitschke, 1826), Blackneck
Recorded 12.vi.1966.

* ***Scoliopteryx libatrix* (Linnaeus, 1758)**, Herald
At m.v. and also found aestivating in the ice house.

Laspeyria flexula (Denis & Schiffermüller, 1775), Beautiful Hook-tip
Recorded 28.vii.1978.

***Rivula sericealis* (Scopoli, 1763)**, Straw Dot
First recorded 9.vii.1971.

* *Hypena proboscidalis* (Linnaeus, 1758), Snout

***Schrankia costaestrigalis* (Stephens, 1834)**, Pinion-streaked Snout
Recorded 6.vii.2000, the first Middlesex record.

Zanclognatha tarsipennalis (Treitschke, 1835), Fan-foot
Recorded 19.viii.1968.

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I must first thank Dr John Bradley who has been responsible for the great majority of observations recorded here and who has offered advice over the annotated list presented below. I have considered it a great privilege to be able to carry on the work where he left off and would particularly like to thank him for his help and encouragement. Special thanks are also due to

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PLATE I. Buckingham Palace Garden, London. Semi-natural vegetation by The Lake at Mudhole provides an important source of larval food plants for Lepidoptera and other insects. *Photographed © by Mark Lane*

The caddisflies (Trichoptera) of Buckingham Palace Garden

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Abstract

Light-trap catches of adult Trichoptera have resulted in a total of 20 species being recorded from Buckingham Palace Garden, of which seven have been added since the original survey. One species, *Ceraclea senilis* (Burmeister), is Nationally Notable in the UK. Comparisons of the fauna are made with species known from the London area.

Introduction

With 198 species recorded from the British Isles (Barnard, 1999) the caddisflies are one of our largest groups of freshwater insects, and their often restricted ecological requirements, coupled with the fact that almost any water-body can harbour at least a few species, means that they are useful environmental indicators. However, most of the species found in the London area are common and widespread throughout the UK, and those recorded in Buckingham Palace Garden are no exception, apart from *Ceraclea senilis* which is a Nationally Notable species (Wallace, 1991).

The original survey (Richards, 1964a) produced a fairly typical list of thirteen species of adult Trichoptera caught in the light-trap, with two species of caddis larvae found in the lake, only one of which could be identified with any certainty (Evans *et al.*, 1964). However, Dr J. D. Bradley continued to run a mercury-vapour light-trap through the late 1960s and 1970s in the Garden, principally to catch Lepidoptera (see Bradley & Mere 1966) and a total of 78 Trichoptera were caught during this period, all of which were deposited in The Natural History Museum, London. These represented thirteen species, seven of which were additions to the original list. Some of these were misidentified by an earlier worker, but the records had not been published, so the opportunity has been taken to re-identify all this material and to present the records here. During the most recent collecting activity in 1995 twelve specimens were caught in the light-trap on The Mound, with two more in the Malaise trap, but no new species were added to the list.

Although there are few published records of this group from central London, there is much relevant material in the collections of The Natural History Museum, and comparisons can also be made with specimens captured at light in the museum's Wildlife Garden in South Kensington since 1995. Recently published studies on the freshwater faunas in outer London areas include one on the New River (Smith 1989). It should be noted that the list of species for the London area compiled by Richards (1964b) is rather strange: even allowing for changes in nomenclature and possible misidentifications it is not a typical list for south-east England, and some of the species and habitats are poorly matched.

Collecting Methods

As noted above, all the adults collected from the Garden were caught in light-traps, with just two recent specimens of *Tinodes waeneri* in the Malaise trap. Different collecting methods can give very different pictures of the apparent fauna of an area, and this is particularly true for Trichoptera. Some species are not attracted to light at all, and others show a marked sexual difference in their reaction to light-traps (Crichton 1960); moreover some of the larger Limnephilidae fly considerable distances, up to 1 or 2 km from their emergence site as part of their normal dispersive behaviour (Crichton 1960), and so the regular trapping of a particular species does not necessarily mean that it is breeding in the immediate vicinity. Other species fly very little, and are hard to catch with any normal trapping method, so that hand-netting and individual searching are necessary. It is only the finding of caddis larvae in a body of water that guarantees the presence of a species, and unfortunately the lake in Buckingham Palace Garden has yielded very few specimens.

Discussion

All the species recorded from the Garden are listed below, with individual records of every specimen caught after the original survey. Comparisons are made with known collections from London, especially The Natural History Museum's Wildlife Garden (all specimens identified by the author). An indication of the status of each species is given, using the definitive work by Wallace (1991). The most interesting species found in the Garden is undoubtedly *Ceraclea senilis* to which Wallace gives 'Notable' status, although it is known from several sites in south-east England. Apart from the special status of this species, its larvae feed on freshwater sponges, as do several species of *Ceraclea* though not those of *C. dissimilis*, the other species found in the Garden. So if *C. senilis* really breeds there the presence of sponges in the lake is indicated, and this is also shown by the capture in Bradley's light-trap of several sponge-flies (Neuroptera: Sisyridae), whose larvae are also dependent on freshwater sponges (Kirby 1981). The larva of '*Leptocerus* sp.' recorded in the original survey (Evans *et al.* 1964) was probably a specimen of *Athripsodes* or *Ceraclea*, but in the absence of any voucher specimens it is impossible to say which.

The sex ratios of specimens caught in the light-trap are also of interest, although the numbers of most species are too low to be analysed meaningfully. Of the 21 specimens of *Mystacides longicornis*, 12 are males, and this corresponds with the usual slight preponderance of males in light-trap catches (Crichton 1960). However, this species forms large mating swarms, and the accidental capture of part of a large swarm can strongly influence the recorded sex ratio. All except three of the 27 specimens of *Tinodes waeneri* were males, and this is very unusual. In light-trap catches this species usually shows a proportion of males of at most around 70% whether caught in a mercury-vapour trap (Crichton 1965) or in Rothamsted traps (Crichton & Fisher 1982).

With the total numbers collected being small, and with the uncertainty about which species actually breed in the lake it is not possible to make predictions about any further species one might expect to see recorded, nor to make any meaningful comparison with the original survey. Twenty species is not a particularly low total number for such an inner city site, and any further additions to the list are likely to be chance captures of dispersing individuals.

An annotated list of Trichoptera recorded in Buckingham Palace Garden

In the following list [1964] means that the species was recorded in the first survey, but the exact year of capture is not known. All specimens were caught in light-traps except where indicated. The Natural History Museum is abbreviated to NHM, and the nomenclature follows Barnard (1985). Most records relate to light-trapped material, caught between the two main surveys. Therefore the list has been exempted from the editorial requirement for the use of asterisks to denote species recorded as new in the 1995 to 1997 survey and the use of round brackets to indicate species not refound since the 1960s survey.

TRICHOPTERA

HYDROPTILIDAE

Agraylea multipunctata Curtis, 1834

vii [1964]; 1♂, 23.vi.1975. Common in weedy ponds and lakes, recorded in the London area, including the NHM Wildlife Garden.

Hydroptila sparsa Curtis, 1834

1♀, 26.vii.1972. Common in southern England, generally in flowing water; recorded in the London area, including the NHM Wildlife Garden.

Orthotrichia costalis (Curtis, 1834)

vii [1964] (as *O. tetensii*); 1♀, 10.vii.1972; 1♀, 14.v.1976; 1♀, 20.v.1979. Local but widespread in still or slow water.

PSYCHOMYIIDAE

Lype phaeopa (Stephens, 1836)

vii, ix [1964]. Common in larger water bodies; recorded from the London area.

Tinodes waeneri (L., 1758)

3♂, 24.v.1972; 2♂, 22.vi.1972; 3♂, 14.vii.1972; 2♂, 19.vii.1972; 1♂, 24.vii.1972; 3♂, 21.v.1973; 1♂, 15.viii.1973; 1♂, 17.vi.1974; 1♂, 25.vi.1974; 1♂, 16.viii.1974; 3♂, 6.vi.1975; 1♂, 21.vii.1975; 1♂, 11.ix.1975; 1♂, 9.vi.1976; 1♂, 7.x.1977; 1♂, 19.vii.1995; 1♂, 20.vii.1995; 1♂, 17-24.viii.1995 (Malaise trap); 1♂, 1♀, 24.viii.1995; 1♂, 7-22.ix.1995 (Malaise trap); 2♂, 2♀, 22.ix.1995. Common in lakes and slow rivers; known from the Serpentine and the NHM Wildlife Garden, but curiously not recorded in the original Buckingham Palace Garden survey.

POLYCENTROPODIDAE

Cyrnus flavidus McLachlan, 1864

vii [1964]. Common in large ponds and lakes; known from the Serpentine and the NHM Wildlife Garden.

PHRYGANEIDAE

Phryganea bipunctata Retzius, 1783

1♀, 3.vi.1970. Common in weedy ponds and lakes; recorded from the London area.

LIMNEPHILIDAE

Stenophylax permistus McLachlan, 1895

x [1964]. Common in ditches and small streams, but can fly considerable distances from breeding sites; recorded in the London area.

Anabolia nervosa (Curtis, 1834)

1♂, 31.ix.1972; 1♂, 7.x.1977; 1♂, 6.x.1978. Common in rivers, lakes and large ponds; recorded from the London area.

Glyphotaelius pellucidus (Retzius, 1783)

vi, viii [1964]. Common, especially in temporary pools surrounded by deciduous trees, but can fly long distances from breeding sites; recorded from the London area.

Limnephilus affinis Curtis, 1834

vii, ix, x [1964]. Common in temporary water-bodies, especially saltmarshes or waste sites, but the adults fly long distances from breeding sites; recorded from the London area, including the NHM Wildlife Garden.

Limnephilus flavicornis (F., 1787)

1♀, 3.x.1973. Common in many types of water-bodies; recorded from the London area.

Limnephilus marmoratus Curtis, 1834

x [1964]. Common in many types of water-bodies.

LEPTOCERIDAE

Athripsodes cinereus (Curtis, 1834)

1♀, 28.vi.1972; 1♂, 10.vii.1972; 1♀, 14.vii.1972; 2♂, 1♀, 19.vii.1972. Common in still or flowing water with stony or sandy substrates; recorded from Hyde Park.

Ceraclea dissimilis (Stephens, 1836)

1♂, 7.vi.1972; 1♀, 16.vi.1972; 1♀, 22.vi.1972. Common in rivers and lakes; recorded from the London area, including the NHM Wildlife Garden.

Ceraclea senilis (Burmeister, 1839)

1♀, 16.vi.1972; 2♂, 14.vii.1972; 1♂, 2♀, 19.vii.1972; 1♀, v.1973; 1♂, 11.vi.1973; 1♀, 15.vi.1977. Although moderately common in still or slow water in a restricted part of south-east England, this is a 'Notable' species in Britain (Wallace, 1991); recorded from the London area. The larva feeds on freshwater sponges, so it would be interesting to confirm if the species really breeds in Buckingham Palace Garden lake.

Mystacides azurea (L., 1761)

vii [1964]; 1♀, 19.vii.1976. Common in still and flowing water; recorded from the Serpentine and the NHM Wildlife Garden.

Mystacides longicornis (L., 1758)

Larva [1964]; vi to x [1964]; 1♂, 28.vi.1972; 1♂, 1♀, 10.vii.1972; 3♂, 1♀, 14.vii.1972; 4♂, 5♀, 19.vii.1972; 1♂, 26.vii.1972; 1♂, 29.vii.1974; 1♀, 6.x.1978; 1♀, 20.vii.1995; 1♂, 24.viii.1995. Common in still and slow-flowing water; recorded from the Serpentine and the NHM Wildlife Garden.

Oecetis ochracea (Curtis, 1825)

vi to viii [1964]; 3♀, 19.vii.1972; 1♂, 24.viii.1995.
Common in still and slow-flowing water; recorded from the Serpentine and the NHM Wildlife Garden.

Leptocerus tineiformis Curtis, 1834

viii [1964] (recorded as *Setodes tineiformis*); 1♀, 19.vii.1972; 1♀, 20.vii.1995.
Common in weedy ponds and lakes in south-east England, although 'Notable' in other parts of the country (Wallace, 1991); recorded from the London area, including the NHM Wildlife Garden.

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Nematocera (Diptera) in Buckingham Palace Garden

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Abstract

Nematoceran Diptera were sampled in Buckingham Palace Garden using a single Malaise trap, operated from 20 April 1995 to 18 August 1997, and through field survey during the years 1997 and 1998. A total of 183 species was recorded. Together with additional species recorded in an earlier survey, the overall total of Nematocera for the Garden is 196. All of the recorded species are presented in an annotated list. Diptera other than Nematocera are the subject of a separate paper in this volume, by a different author.

Introduction and survey methods used

Visits were made to Buckingham Palace Garden on five occasions during 1997 and 1998. Nematocera collected on these trips were supplemented by those sorted by Colin Plant from samples accumulated through continuous use of a Malaise trap on The Mound, from 20 April 1995 to 18 August 1997.

Fungus gnats (Bolitophilidae, Keroplatidae and Mycetophilidae) are discussed more fully in a separate paper in this volume; Chironomidae are similarly treated by a different author. These species are included in the annotated list, below, without comment in order that a single, complete list of species may be presented.

An annotated list of Nematocera (Diptera) recorded in Buckingham Palace Garden

The sequence and nomenclature follow Chandler (1998). Species found in the earlier survey (Richards, 1964), but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey. The fungus gnat families (Bolitophilidae, Keroplatidae and Mycetophilidae) and the Chironomidae are the subject of separate chapters and their species are merely listed here, without comment, for sake of completeness. The lists for Tipulidae, Pediciidae and Limoniidae were compiled by Alan Stubbs (information on sample dates unavailable), the Psychodidae by Phil Withers and the Chaoboridae and Chironomidae by Peter Langton. Lists for other families were compiled by Peter Chandler.

DIPTERA
NEMATOCERA
TIPULOMORPHA
TIPULIDAE

Of the 87 British species of long-palped craneflies, seven are recorded from the Garden in the present survey, two of them being among the four species recorded during the previous survey. *Tipula vernalis*, *T. paludosa* and *Nephrotoma flavescens* typify dry grassland of reasonably natural character (the absence of *Nephrotoma appendiculata* (Pierre) is surprising), and *T. pagana* frequents mossy grass. *N. flavipalpis* is the only real woodland species and *Tipula confusa* develops in moss in shaded or unshaded situations. *N. guestfalica*, though nationally rather local, is not uncommon even well into London. Of the two species previously recorded, which are apparently no longer present, *Tipula cava* usually inhabits heathland and would not be expected in this type of habitat, while *T. oleracea* requires wet soil for development and areas adjacent to the lake may be drier now than formerly.

TIPULINAE

Nephrotoma flavescens (Linnaeus, 1758)
Malaise trap.

* *Nephrotoma flavipalpis* (Meigen, 1830)
Malaise trap. Also frequent in the wooded fringes of the Garden on August and October visits in 1997 and 1998. Also recorded in May and June on the previous survey.

N. guestfalica (Westhoff, 1879)
Malaise trap.

(*Tipula* (*Lunatipula*) *cava* Riedel, 1913)
Recorded at light in July during the previous survey.

Tipula (*Lunatipula*) *vernalis* Meigen, 1804
Malaise trap.

* *Tipula* (*Savtshenkia*) *confusa* van der Wulp, 1883
Malaise trap. Recorded in October on the previous survey.

Tipula (*Savtshenkia*) *pagana* Meigen, 1818
Malaise trap.

(*Tipula* (*Tipula*) *oleracea* Linnaeus, 1758)
Recorded in April and October on the previous survey, but the similar *T. paludosa* was not then recorded.

Tipula (*Tipula*) *paludosa* Meigen, 1830
Malaise trap. Also recorded at the north end of the Garden on 1.x.1998.

PEDICIIDAE

Most of the hairy-eyed craneflies have aquatic or semi-aquatic larvae, the sharp-sided lake margin being unsuitable. However, *Ula* develops in fungi in woodland and its survival so far into London is of note.

Ula mollissima Haliday, 1833
Recorded in the wooded fringe of the Garden on 1.x.1998.

LIMONIIDAE

This is the main group of short-palped craneflies with over 200 British species. Only six species are recorded from the Garden in the present survey; two of them were among the four species recorded during the previous survey. Most species need moist or very wet soils or gently sloping aquatic margins; only *Dicranomyia modesta* and *Symplecta stictica* represent this fauna in very poor habitat. The remaining species recorded from the Garden are typical of dry woodland and tree/shrub edges. *Trimicra pilipes* requires shelved water margins for development, so like *Tipula oleracea* has probably been lost because of changes in management of the lake since the previous survey. The record of *Dicranomyia mitis* (Meigen, 1830) form *lutea* Lackschewitz, 1928 on the previous survey was a misidentification of *D. chorea*; the record was for September and *mitis* itself is an early summer species.

CHIONEINAE

Cheilotrichia (*Empeda*) *cinerascens* (Meigen, 1804)
Malaise trap.

Symplecta stictica (Meigen, 1818)
Malaise trap.

(*Trimicra pilipes* (Fabricius, 1787))
Recorded in August on the previous survey.

LIMONIINAE

* *Dicranomyia chorea* (Meigen, 1818)
Malaise trap. Also recorded on The Mound and wooded fringes at the north end in June and October; on the previous survey it was recorded in April and September.

Dicranomyia modesta (Meigen, 1818)
Recorded on The Mound, the Island and around the wooded fringes on October 1998 visits.

Limonia nubeculosa Meigen, 1804
Malaise trap.

* *Rhipidia maculata* Meigen, 1818
Malaise trap. Recorded in May on the previous survey

BIBIONOMORPHA

BIBIONIDAE

Surprisingly, no species of the genus *Bibio* have been recorded in the Garden. *Dilophus febrilis* is generally very common. The larvae develop in soil, feeding on living and dead plant material and often cause damage to roots.

Dilophus febrilis (Linnaeus, 1758)
Malaise trap, a few seen from May and August samples.

BOLITOPHILIDAE

Bolitophila(Cliopisa) pseudohybrida Landrock, 1912

KEROPLATIDAE

KEROPLATINAE

Neoplatyura modesta (Winnertz, 1863)
Orfelia nemoralis (Meigen, 1818)
Orfelia tristis (Lundström, 1911)

MACROCERINAE

Macrocera phalerata Meigen, 1818
Macrocera stigmoides Edwards, 1925

MYCETOPHILIDAE

GNORISTINAE

Boletina gripha Dziedzicki, 1885

LEIINAE

Clastobasis alternans (Winnertz, 1863)
Docosia fumosa Edwards, 1925
Docosia gilvipes (Haliday in Walker, 1856)
Leia bimaculata (Meigen, 1804)
Leia fascipennis Meigen, 1818
Tetragoneura sylvatica (Curtis, 1837)

MYCETOPHILINAE

Exechiini

Allodia ornaticollis (Meigen, 1818)
Allodiopsis domestica (Meigen, 1830)
Brevicornu fissicauda (Lundström, 1911)
Brevicornu griseicolle (Staeger, 1840)
Brevicornu sericoma (Meigen, 1830)
Brevicornu verralli (Edwards, 1925)
Cordyla crassicornis Meigen, 1818
Cordyla fissa Edwards, 1925
Cordyla murina Winnertz, 1863
Cordyla pusilla Edwards, 1925
Exechia bicincta (Staeger, 1840)
Exechia fusca (Meigen, 1804)
Exechia repanda Johannsen, 1912
Exechia spinuligera Lundström, 1912
Tarnania fenestralis (Meigen, 1818)

Mycetophilini

Mycetophila britannica Lastovka & Kidd, 1975
Mycetophila cingulum Meigen, 1830
Mycetophila curviseta Lundström, 1911
Mycetophila fraterna Winnertz, 1863
Mycetophila freyii Lundström, 1909
* *Mycetophila fungorum* (De Geer, 1776)
Mycetophila ornata Stephens, 1846
Mycetophila pictula Meigen, 1830
Mycetophila trinotata Staeger, 1840
Mycetophila unicolor Stannius, 1831
Platurocypta punctum (Stannius, 1831)
Platurocypta testata (Edwards, 1925)
Phronia humeralis Winnertz, 1863
Sceptonia cryptocauda Chandler, 1991
Sceptonia flavipuncta Edwards, 1925
Sceptonia membranacea Edwards, 1925
Sceptonia nigra (Meigen, 1804)
Trichonta foeda Loew, 1869
Trichonta melanura (Staeger, 1840)
Zygomyia notata (Stannius, 1831)
Zygomyia pseudohumeralis Caspers, 1980
Zygomyia valida Winnertz, 1863
Zygomyia vara (Staeger, 1840)

MYCOMYINAE

Mycomya (Mycomya) ?flavicollis (Zetterstedt, 1852)

SCIOPHILINAE

Acnemia nitidicollis (Meigen, 1818)
Sciophila parviareolata Santos Abreu, 1920
Sciophila lutea Meigen, 1818
Sciophila thoracica Staeger, 1840

SCIARIDAE

This family was not recorded during the previous survey. They develop mainly in decomposing materials, some in rotten wood and fungi but several of the species recorded in the Garden are known to develop in the nests of birds or mammals. Knowledge of the distribution of Sciaridae is still at an early stage. Most of the 22 species identified are known to be widespread; *Bradysia normalis* has been recorded mainly from Scotland, but is also known from Suffolk (Laurence, 1994) and Surrey (The Sheep Leas, Horsley, 16.v.1991, P.J. Chandler). Some other species of *Bradysia* were found, but await identification.

Bradysia amoena Winnertz, 1867
Malaise trap 19.vi – 18.vii and 18.vii – 13.viii.1997.

Bradysia arcana Menzel & Mohrig, 1998
Malaise trap 11.vii – 11.viii.1996, 5.ix – 21.x.1996 and 27.iii – 24.iv.1997.

Bradysia confinis (Winnertz, 1867)
Malaise trap 24.iv – 15.v.1997.

Bradysia normalis Frey, 1948
Malaise trap 3 – 10.viii.1995, 11.vii – 1.viii.1996, 26.v – 19.vi.1997 and 18.vii – 13.viii.1997.

Bradysia placida (Winnertz, 1867)
Malaise trap 19.ii – 27.iii.1997, 27.iii – 24.iv.1997 and 18.vii – 13.viii.1997.

Corynoptera curvispinosa Freeman, 1983
Malaise trap 27.v – 19.vi.1997.

Corynoptera forcipata (Winnertz, 1867)
Malaise trap 3 – 10.viii.1995, 10 – 17.viii.1995 and 20 – 28.ix.1995.

Corynoptera globiformis (Frey, 1945)
Malaise trap 20 – 28.ix.1995, 5.ix – 21.x.1996 and 18.vii – 13.viii.1997.

Corynoptera parvula (Winnertz, 1867)
Malaise trap 18.vii – 13.viii.1995.

Corynoptera sedula Mohrig & Krivosheina, 1985
Malaise trap 5.ix – 21.x.1996 and 27.iii – 24.iv.1997.

Ctenosciara hyalipennis (Meigen, 1804)
Malaise trap 19.ii – 27.iii.1997, 27.iii – 27.iv.1997 and 19.vi – 18.vii.1997.

Leptosciarella (*Leptosciarella*) *rejecta* (Winnertz, 1867)
Malaise trap 28.v – 27.vi.1995, 5.ix – 21.x.1996, 27.iii – 27.iv.1997, 19.vi – 18.vii.1997 and 18.vii – 13.viii.1997.

Leptosciarella (*Leptosciarella*) *trochanterata* (Zetterstedt, 1851)
Malaise trap 5.ix – 21.x.1996, 26.v – 19.vi.1997 and 18.vii – 13.viii.1997. On the Island on 13.viii.1997.

Lycoriella (*Lycoriella*) *castanescens* (Lengersdorf, 1940)
Malaise trap 27.iii – 27.iv.1997.

Lycoriella (*Lycoriella*) *ingenua* (Dufour, 1839)
Malaise trap 18.viii – 5.ix.1995 and 21.x – 28.xi.1996.

Phytosciara (*Prosciara*) *ungulata* (Winnertz, 1867)
Malaise trap 18.vii – 13.viii.1997.

Pseudolycoriella bruckii (Winnertz, 1867)
Malaise trap 27.vi – 16.vii.1996 and 26.v – 19.vi.1997.

Scatopsciara (*Scatopsciara*) *atomaria* (Zetterstedt, 1851)
Malaise trap 14.i – 19.ii.1997, 19.ii – 27.iii.1997 and 18.vii – 13.viii.1997.

Scatopsciara (*Scatopsciara*) *multispina* (Bukowski & Lengersdorf, 1936)
One male was found at the north end of the Garden on 26.vi.1998.

Scatopsciara (*Scatopsciara*) *vitripennis* (Meigen, 1818)
Malaise trap 7 – 20.v.1995, one female.

Schwenkfeldina carbonaria (Meigen, 1830)
Malaise trap18 – 27.vi.1996.

Trichosia (*Trichosia*) *confusa* Menzel & Mohrig, 1997
Malaise trap 15.viii – 5.ix.1995.

CECIDOMYIIDAE

This family of more than 600 British species was not studied during either survey. Many species are gall causers on plants and should be well represented in the Garden.

LESTREMIINAE

Lestremia cinerea Macquart, 1826
Malaise trap 7 – 20.v.1995.

CECIDOMYIINAE

Dasineura crataegi (Winnertz, 1853)
A gall causer on hawthorn, *Crataegus* species.

PSYCHODOMORPHA

PSYCHODIDAE

The moth flies or owl midges were not recorded during the previous survey and relatively few were sorted from Malaise trap catches during the present survey, so the list of 12 species identified may not be fully representative of the Garden's fauna. Most of the species recorded are terrestrial. *Trichomyia urbica* develops in rotten wood, *Philosepedon humeralis* develops in decaying snails and *Psychoda* species exploit a wide range of decaying materials; *P. cinerea* and *P. phalaenoides* develop in decaying terrestrial gill fungi as well as other decomposing materials. *Tinearia alternata* has been reared from nests of birds and mammals, as well as wet decomposing materials. The only aquatic species found, all of which occurred at the lake margin, were *Paramormia ustulata* and the two *Pericoma* species, of which *P. trivialis* is the most widespread and tolerant of pollution, while *P. pseudoexquisita* is often associated with algal mats.

PSYCHODINAE

Pericomini

Pericoma (Pericoma) pseudoexquisita Tonnoir, 1940
At lake margin 1.x.1998.

Pericoma (Pneumia) trivialis Eaton, 1893
At lake margin 13.viii1997 and 1.x.1998.

Psychodini

Psychoda albipennis Zetterstedt, 1850
Malaise trap 1.vi.1995; 11.vii – 1.viii.1996; >21.x.1996; 19.ii – 27.iii.1997; 16.v – 19.vi.1997; 19.vi – 18.vii.1997; 18.vii – 13.viii.1997. Light trap 1.vi.1995.

Psychoda cinerea Banks, 1894
Malaise trap 18.vii – 13.viii.1997.

Psychoda grisescens Tonnoir, 1922
Light trap 15.vi.1995.

Psychoda minuta Banks, 1894
Malaise trap 19.vi – 18.vii.97 and 18.vii – 13.viii.1997.

Psychoda phalaenoides (Linnaeus, 1758)
Malaise trap 20 – 28.vii.1995 and 18.vii – 13.viii.1997.

Psychoda setigera Tonnoir, 1922
Malaise trap 18.vii – 13.viii.1997.

Tinearia alternata (Say, 1824)
Malaise trap 17 – 24.viii.1995; 11.vii – 1.viii.1996; >21.x.1996.

Telmatoscopini

Paramormia ustulata (Haliday in Walker, 1856)
Malaise trap 31.viii – 7.ix.1995. Also at lake margin 1.x.1998

Philosepedon humeralis (Meigen, 1818)
Malaise trap 7 – 22.ix.1995.

TRICHOMYIINAE

Trichomyia urbica Haliday in Curtis, 1839
Malaise trap 7 – 20.v.1995 and 11.vii – 1.viii.1996.

TRICHOCERIDAE

It is surprising that only a single species of winter gnat was recorded on both surveys and that none were found in the Malaise trap catches; several other species should occur. Larvae develop in decaying vegetation and in fungi.

* *Trichocera (Metatrichocera) annulata* Meigen, 1818
This was recorded on the Island on 1.x.1998. It was also recorded in October by Richards (1964).

ANISOPODIDAE

Both species recorded develop in decaying vegetable matter, but *S. cinctus* also develops in fungi and sap runs.

Sylvicola cinctus (Fabricius, 1787)
Malaise trap 20.v – 23.vi.1995, 20.x – 21.xi.1995, 25.iii – 11.iv.1996 and 18.vii – 13.viii.1997. Also found on The Mound on 1.x.1998.

* *Sylvicola punctatus* (Fabricius, 1787)
Malaise trap >7.vii.1995, 14.i – 19.ii.1997 and 19.vi – 18.vii.1997. Recorded in May and October in the previous survey.

MYCETOBIIDAE

The species of this family develop in sap runs and associated wood detritus. *M. pallipes* is widespread, although it has been accorded Nationally Scarce conservation status.

Mycetobia pallipes Meigen, 1818
Malaise trap 18.vii – 13.viii.1997. It was also recorded in the wooded fringe near the north end on 1.x.1998.

SCATOPSIDAE

Only one species of this family was recorded on each survey, but several others should occur. They develop in decaying materials, including in the nests of birds and mammals.

SCATOPSINAE

Scatopsini

(*Scatopse notata* (Linnaeus, 1758))
This is a common species and was recorded during October on the previous survey.

Swammerdamellini

Swammerdamella brevicornis (Meigen, 1830)
Malaise trap 10 – 17.viii.1995.

CULICOMORPHA

CHAOBORIDAE

The single species recorded is common and has aquatic larvae, evidently developing in the lake.

Chaoborus (*Chaoborus*) *flavicans* (Meigen, 1830)
Malaise trap 31.viii – 7.ix.1995; 10 – 17.viii.1995.

CULICIDAE

The three species recorded by Edwards (1926) as developing in water-filled tree holes have not been found again on either survey, so *Culex pipiens* is the only mosquito confirmed to exist in the Garden today. *Orthopodomyia pulcripalpis* is currently accorded RDB3 conservation status and has been recorded at only four sites since 1960.

ANOPHELINAE

(*Anopheles* (*Anopheles*) *plumbeus* Stephens, 1828)

CULICINAE

(*Aedes* (*Finlaya*) *geniculatus* (Olivier, 1791))

Culex (*Culex*) *pipiens* Linnaeus, 1758
Malaise trap frequently from July to November. It was also recorded on The Mound and in the wooded fringes at the north end on 1.x.1998.

(*Orthopodomyia pulcripalpis* (Rondani, 1872))

CERATOPOGONIDAE

Relatively little material of this family has been studied from the Garden, except for *Dasyhelea dufouri*, which was seen to be abundant during visits by the author. The biting midges of the genus *Culicoides* appear to be scarce, but this may be due to lack of habitat as most develop in damp soil. Most of the species recorded are terrestrial as larvae, some in decaying vegetation or tree rot holes (some *Dasyhelea* species). *Culicoides scoticus* is a polyphagous fungus feeder and *Forcipomyia kaltenbachii* has also been reared from the fungus *Suillus luteus*, as well as from sap runs and under bark; *F. pulchrithorax* has also been reared from sap runs. Of the many species with aquatic larvae, only *Bezzia annulipes* was recorded during the present survey although one other, *Sphaeromias pictus*, was recorded during the previous survey. This is surprising, as some of the commoner species might have been expected to be present in the lake. *Forcipomyia eques* is not often recorded, but is of interest in that adult females suck fluids from the wing veins of lacewings (Neuroptera, Chrysopidae).

CERATOPOGONINAE

Culicoidini

Culicoides (*Avaritia*) *scoticus* Downes & Kettle, 1952
Light trap 1.vi.1995, male and female.

(*Culicoides* (*Culicoides*) *punctatus* (Meigen, 1804))
Recorded in July during the previous survey and determined by Paul Freeman.

Culicoides (*Oecacta*) *festivipennis* Kieffer, 1914
Light trap 1.vi.1995, male.

Culicoides (*Oecacta*) *vexans* (Staeger, 1839)
Light trap 15.vi.95.

Palpomyiini

Bezzia (*Homobezzia*) *annulipes* (Meigen, 1830)
Light trap 1.vi.1995, one female.

Sphaeromiini

(*Sphaeromias pictus* (Meigen, 1818))
This was taken at light in July during the previous survey. This is of interest as it was confused with *S. fasciatus* (Meigen, 1804) until recently, but was confirmed as British by Chandler (1994) and is widespread but uncommon.

DASYHELEINAE

Dasyhelea (*Dasyhelea*) *dufouri* (Laboulbène, 1869)
Malaise trap frequent from June to November. It was also numerous in all wooded parts of the Garden on 13.viii.1997, 26.vi.1998 and 1.x.1998.

Dasyhelea (*Dasyhelea*) *versicolor* (Winnertz, 18562)
Malaise trap 31.viii – 7.ix.1995 and 7 – 23.ix.1995, males; possible females were seen from several other samples.

Dasyhelea (*Dicryptoscena*) ?*notata* Goetghebuer, 1920
Malaise trap 10 – 17.viii.1995, 31.viii – 7.ix.1995 and 7 – 23.ix.1995. Females only were found.

FORCIPOMYIINAE

Forcipomyia (*Forcipomyia kaltenbachii* (Winnertz, 1852)
Light trap 1.vi.1995, one female.

Forcipomyia (*Forcipomyia*) *pulchrithorax* Edwards, 1924
Malaise trap 31.viii – 7.ix.1995 male and female, 7 – 23.ix.1995 female and 7 – 15.viii.1996 female.

Forcipomyia (*Trichohelea*) *eques* (Johannsen, 1908)
Light trap 15.vi.1995 female and 28.vii.1995 male. Malaise trap 18.vii – 13.viii.1997 female.

CHIRONOMIDAE

CHIRONOMINAE

Chironomini

Chironomus (Camptochironomus) pallidivittatus (Malloch, 1915)

Chironomus (Camptochironomus) tentans Fabricius, 1805

Chironomus (Chironomus) annularius auctt.

Chironomus (Chironomus) cingulatus Meigen, 1830

Chironomus (Chironomus) commutatus Keyl, 1960

Chironomus (Chironomus) dorsalis auctt.

Chironomus (Chironomus) luridus Strenzke, 1959

Chironomus (Chironomus) nuditarsis Keyl, 1961

Chironomus (Chironomus) piger Strenzke, 1959

* *Chironomus (Chironomus) plumosus* (Linnaeus, 1758)

Chironomus (Chironomus) prasinus Meigen, 1804

Chironomus (Chironomus.) riparius Meigen, 1804

Cladopelma virescens (Meigen, 1818)

(*Cryptochironomus supplicans* (Meigen, 1830))

Dicrotendipes nervosus (Staeger, 1839)
Dicrotendipes objectans (Walker, 1856)
Einfeldia pagana (Meigen, 1838)
Endochironomus tendens (Fabricius, 1775)
Glyptotendipes (Glyptotendipes) glaucus (Meigen, 1818)
Glyptotendipes (Glyptotendipes) pallens (Meigen, 1804)
Microchironomus tener (Kieffer, 1918)
Microtendipes chloris (Meigen, 1818)
Microtendipes pedellus (De Geer, 1776)
Parachironomus arcuatus (Goetghebuer, 1919)
Parachironomus frequens (Johannsen, 1905)
(*Parachironomus monochromus* (van der Wulp, 1874))
Polypedilum (Pentapedilum) sordens (van der Wulp, 1874)
Polypedilum (Polypedilum) acutum Kieffer, 1915
* *Polypedilum (Polypedilum) nubeculosum* (Meigen, 1804)
Polypedilum (Polypedilum) pedestre (Meigen, 1830)
Polypedilum (Tripodura) scalaenum (Schrank, 1803)

Tanytarsini
(*Micropsectra junci* (Meigen, 1818))
Paratanytarsus dissimilis (Johannsen, 1905)
(*Paratanytarsus laetipes* (Zetterstedt, 1850))
Tanytarsus eminulus (Walker, 1856)
Tanytarsus mendax Kieffer, 1925
Tanytarsus usmaensis Pagast, 1931

ORTHOCLADIINAE
Bryophaenocladius aestivus (Brundin, 1947)
Bryophaenocladius ictericus (Meigen, 1830)
Bryophaenocladius nidorum (Edwards, 1929)
Bryophaenocladius vernalis (Goetghebuer, 1921)
Cricotopus (Cricotopus) annulator Goetghebuer, 1927
Cricotopus (Cricotopus) bicinctus (Meigen, 1818)
Cricotopus (Cricotopus) similis Goetghebuer, 1921
Cricotopus (Isocladius) intersectus (Staeger, 1839)
Cricotopus (Isocladius) sylvestris (Fabricius, 1794)
Limnophyes natalensis (Kieffer, 1914)
Limnophyes paludis Armitage, 1985
Metriocnemus eurynotus (Holmgren, 1883)
Metriocnemus fuscipes (Meigen, 1818)
Metriocnemus picipes (Meigen, 1818)
Paratrichocladius rufiventris (Meigen, 1830)
Smittia aterrima (Meigen, 1818)
Smittia pratorum (Goetghebuer, 1927)

TANYPODINAE
Macropelopiini
Psectrotanypus (Psectrotanypus) varius (Fabricius, 1787)

Pentaneurini

Ablabesmyia monilis (Linnaeus, 1758)
Conchapelopia melanops (Meigen, 1818)

Procladiini

* *Procladius (Holotanypus) choreus* (Meigen, 1804)
Procladius (Holotanypus) sagittalis (Kieffer, 1909)
Procladius (Psilotanypus) lugens Kieffer, 1915
* *Procladius (Psilotanypus) rufovittatus* (van der Wulp, 1874)

Tanypodini

Tanypus punctipennis Meigen, 1818
Tanypus vilipennis (Kieffer, 1918)

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Fungus Gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) in Buckingham Palace Garden

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Abstract

Fungus gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) were sampled at Buckingham Palace Garden, using a single Malaise trap operated from 1995 to 1997 (samples were examined from 20.iv.1995 to 13.viii.1997) and five field visits in 1997 and 1998. A total of 56 species were recorded, only one of which had been recorded in an earlier survey. The species are listed and their biological associations discussed. The fauna was larger than might be expected in a site of this type but most species were recorded in small numbers, reflecting availability of suitable habitat.

Introduction and survey methods used

There are 535 British species of fungus gnats belonging to the above families and two smaller families not found in the Garden, Ditomyiidae and Diadocidiidae. Most species are associated as larvae with fungi. Many develop internally in the tissue of gill fungi, boletes or the softer polypores. The larvae of many others live in more or less slimy webs on the surface of wood encrusting fungi or rotten wood and some develop internally in rotten wood, feeding on fungal mycelium. Some of the web spinners are spore feeders while others have carnivorous larvae. A few develop in bird's nests while the biology of some genera is unknown.

This group was not studied during the previous survey (Richards, 1964) and only one common species, *Mycetophila fungorum* (De Geer) was then recorded. This and 55 other species were found during the present survey, mostly recorded from the Malaise trap samples from April 1995 to August 1997, which produced 51 species. Specimens were, however, mostly in low numbers and relatively few species (a maximum of 22) were found in each sample.

Five visits were also made by the author in 1997 and 1998, three of them in October, usually a peak month for this group, coinciding with greater abundance of fruiting bodies of the larger fungi. However adults were in small numbers, both of individuals and species, on all visits and only 16 species were recorded altogether (15 of them during October) and only five of these were not found in the Malaise trap. There is also usually another peak in early summer, but visits at that time were not practicable. The other visits were on 26 June 1998 and 13 August 1997 and these produced only one and three species respectively.

This was partly attributable to dry prevailing weather, but the autumn in 1998 was wetter and following a visit on 1 October, a second was arranged on 19 October. On the latter visit, fungus fruiting bodies were especially prolific and according to Alick Henrici who was present on that occasion, more abundant than he had previously seen there. However, that visit was of necessity curtailed and few species were recorded; two species were subsequently reared from a fresh cap of the fly agaric *Amanita muscaria*, of which there was a colony on the lakeshore. No further recording was practicable after that date.

Results

Most species of this group favour woodland and forest habitats and a large fauna would not be expected in such an intensively managed site. The total of 56 species eventually achieved (10.5 per cent. of the British species) is probably not far short of the actual fauna of the Garden, but more intensive recording at different times of year and in more favourable seasons would probably add several other widespread species.

An annotated list of the fungus gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) recorded in Buckingham Palace Garden

Nomenclature and arrangement follow Chandler (1998) except in respect of changes in Chandler (2001). The biology of species, where known, is stated; this information is mainly based on the compilation of known fly/fungus associations by Yakovlev (1994). The single species found on both surveys is asterisked.

NEMATOCERA

BIBIONOMORPHA

BOLITOPHILIDAE

Bolitophila (Cliopisa) pseudohybrida Landrock, 1912
Malaise trap 20.x – 20.xi.1995. On 19.x.1998 at the north end of the Garden and on the Island in the lake. This species develops in a wide range of terrestrial gill fungi.

KEROPLATIDAE

KEROPLATINAE

Neoplatyura modesta (Winnertz, 1863)
Malaise trap in July and August 1995 and 1997.

Orfelia nemoralis (Meigen, 1818)
Malaise trap frequently from April to August.

Orfelia tristis (Lundström, 1911)
Malaise trap 21.v – 23.vi.95, a male and female. This is a local species of dry grassland and other open habitats.

MACROCERINAE

Macrocera phalerata Meigen, 1818
Malaise trap in October 1996.

Macrocera stigmoides Edwards, 1925
Malaise trap 25.iv – 9.v.1996.

MYCETOPHILIDAE

GNORISTINAE

Boletina gripha Dziedzicki, 1885
Malaise trap regularly from October throughout the winter months to June, with one record for a July/August sample. There is a rearing record from the bolete *Suillus bovinus* but *B. gripha* is a very common species and may not be a regular fungus feeder.

LEIINAE

Clastobasis alternans (Winnertz, 1863)
Malaise trap from the period to 7.vii.1995, one male. See discussion below.

Docosia fumosa Edwards, 1925
Malaise trap to 21.x.1996, both sexes. This species is local in occurrence but develops in bird's nests and is most often recorded by rearing.

Docosia gilvipes (Haliday in Walker, 1856)
Malaise trap from April to November. It is polyphagous in a wide range of fungi, both terrestrial and growing on wood, including polypores and encrusting fungi.

Leia bimaculata (Meigen, 1804)
Malaise trap from April to December. This species is polyphagous in soft fungi, both terrestrial and growing on wood.

Leia fascipennis Meigen, 1818
Malaise trap in several samples from May – July and October. It is a common species, found mainly on tree foliage but the biology is not recorded. Some other species of the genus develop in bird's nests.

Tetragoneura sylvatica (Curtis, 1837)
Malaise trap 20.v – 23.vi.1995, 31.viii – 7.ix.1995. There is a rearing record from an encrusting fungus but it has also been reared from rotten wood, where the larvae probably feed on fungal mycelium.

MYCETOPHILINAE

Execheiini

Allodia ornaticollis (Meigen, 1818)
This was found on the island on 19.x.1998 and subsequently reared from *Amanita muscaria*, which was growing on the lake shore on the same visit. The species is polyphagous in gill fungi (including those growing on wood) and boletes.

Allodiopsis domestica (Meigen, 1830)
Malaise trap 19.vi – 18.vii.1997, one male. It develops in a wide range of terrestrial gill fungi.

Brevicornu fissicauda (Lundström, 1911)
Malaise trap 14.i – 19.ii.1997.

Brevicornu griseicolle (Staeger, 1840)
Malaise trap from November to December, February to April and June to July. It was also recorded widely in the garden on October visits, including the northern wooded fringe, the Island in the lake and on The Mound. It has been reared from terrestrial gill fungi of the genera *Hebeloma*, *Inocybe* and *Cortinarius*.

Brevicornu sericoma (Meigen, 1830)
Malaise trap 21.x – 28.xi.1996. There is one rearing record from the terrestrial gill fungus *Amanita rubescens*.

Brevicornu verralli (Edwards, 1925)
Malaise trap 21.x – 28.xi.1996.

Cordyla crassicornis Meigen, 1818
Malaise trap from February to August and October to November. This species develops in terrestrial gill fungi of the genera *Lactarius* and *Russula*.

Cordyla fissa Edwards, 1925
Malaise trap 19.vi – 18.vii.1997. There is a rearing record from the bolete *Suillus luteus*.

Cordyla murina Winnertz, 1863
Malaise trap from March to August. This develops in terrestrial gill fungi and boletes.

Cordyla pusilla Edwards, 1925
Malaise trap from January to February and April to August.

Exechia bicincta (Staeger, 1840)
Found in the wooded fringe on the northwest side on 1.x.1998. It develops in gill fungi, both terrestrial and growing on wood.

Exechia fusca (Meigen, 1804)
Malaise trap 19.vi – 18.vii.1997. Recorded around the wooded fringes and on the Island in the lake on October visits. This species is polyphagous in mainly terrestrial gill fungi and boletes.

Exechia repanda Johannsen, 1912
Malaise trap 19.vi – 18.vii.1997, one male. It has been reared from several genera of terrestrial gill fungi.

Exechia spinuligera Lundström, 1912
Malaise trap 21.x – 28.xi.1996. This has a similar range of host fungi to *E. fusca*.

Tarnania fenestralis (Meigen, 1818)
This was recorded on the Island on 1.x.1998. This species is polyphagous in the larger terrestrial gill fungi.

Mycetophilini

Mycetophila britannica Lastovka & Kidd, 1975
Malaise trap from October to December. On both visits in October 1998 it occurred around the wooded fringe at the north end. This has been reared from several genera of terrestrial gill fungi but also from the honey fungus *Armillaria mellea* and the soft polypore *Polyporus squamosus.*

Mycetophila cingulum Meigen, 1830
Malaise trap from July to October. This species regularly develops in *Polyporus squamosus*, but adults have also twice been recorded visiting colonies of another soft textured polypore *Grifola frondosa.*

Mycetophila curviseta Lundström, 1911
Malaise trap 18.vii – 17.viii.1997. Found around logs north of the office area on 1.x.1998 and on The Mound on 13.viii.1997. Biology unrecorded but usually around rotten wood.

Mycetophila fraterna Winnertz, 1863
This was recorded on the Island on 31.x.1997. It has been reared from the polypore fungus *Physisporinus vitreus* (Chandler, 1993).

Mycetophila freyii Lundström, 1909
Malaise trap 18.vii – 13.viii.1997, one male.

* *Mycetophila fungorum* (De Geer, 1776)
Malaise trap samples for most months from March to October. It was also found on the Island on 1.x.1998 and reared from *Amanita muscaria* growing on the lake shore on 19.x.1998. This is polyphagous in boletes and gill fungi, both terrestrial and growing on wood. It was recorded in October on the previous survey.

Mycetophila ornata Stephens, 1846
Malaise trap 21.x – 28.xi.1996, one female. This common species is confined to polypores and wood encrusting fungi.

Mycetophila pictula Meigen, 1830
Malaise trap 1 – 15.viii.1996. There is a rearing record from a wood encrusting fungus.

Mycetophila trinotata Staeger, 1840
Malaise trap in June 1995 and July – August 1997. It was recorded around logs north of the office area on 1 October 1998. This is another common species, developing in polypores and encrusting fungi.

Mycetophila unicolor Stannius, 1831
Malaise trap 20.v – 23.vi.1995.

Platurocypta punctum (Stannius, 1831)
Malaise trap in October 1996 and June to July 1997. It was also recorded at the north end of the Garden on 1.x.1998. This species develops in myxomycetes growing on rotten wood.

Platurocypta testata (Edwards, 1925)
Malaise trap in July and November to December. It was also found near the lakeshore in August. The biology is the same as for *P. punctum.*

Phronia humeralis Winnertz, 1863
Malaise trap 9 – 23.v.1996. The larvae of this species develop on the surface of encrusting fungi on damp rotten wood.

Sceptonia cryptocauda Chandler, 1991
Malaise trap from May to October.

Sceptonia flavipuncta Edwards, 1925
Malaise trap 19.vi – 13.vii.1997, one male.

Sceptonia membranacea Edwards, 1925
Malaise trap 19.vi – 13.vii.1997.

Sceptonia nigra (Meigen, 1804)
Malaise trap 16.v – 19.vi.1997, but it was recorded on four visits in June, August and October. It was swept from tree foliage on the Island, around the lakeshore and on The Mound.

Trichonta foeda Loew, 1869
Malaise trap 23.ii – 5.iii.1996. This species develops in the wood encrusting fungus *Stereum hirsutum*.

Trichonta melanura (Staeger, 1840)
Malaise trap 19.vi – 18.vii.1997. This has also been reared from *Stereum*.

Zygomyia notata (Stannius, 1831)
Malaise trap, frequently from May to November.

Zygomyia pseudohumeralis Caspers, 1980
Malaise trap, several specimens from June to August.

Zygomyia valida Winnertz, 1863
Malaise trap in period to 21.x.1996 and 16.v – 19.vi.1997. It was also found on the Island in October.

Zygomyia vara (Staeger, 1840)
Recorded on the Island on 1.x.1998.

MYCOMYINAE

Mycomya (Mycomya) ?flavicollis (Zetterstedt, 1852)
Malaise trap 31.viii – 7.ix.1995, a probable female. Biology unrecorded but most *Mycomya* species form webs on the surface of fungi growing on wood.

SCIOPHILINAE

Acnemia nitidicollis (Meigen, 1818)
Malaise trap 21.x – 28.xi.1996. There are two rearing records from boletes of the genus *Leccinum* but this very common species may not be a regular fungus feeder.

Sciophila parviareolata Santos Abreu, 1920
Malaise trap 12 – 24.viii.1995, 22.ix – 30.x.1995, 27.iii –24.v.1997 and 19.vi – 18.vii.1997. See discussion below.

Sciophila lutea Meigen, 1818
Malaise trap from May to August, typical yellow specimens and 27.iii – 24.iv.1997. darker specimens. This species is polyphagous, with rearing records from the larger ascomycetes as well as polypores, boletes and gill fungi.

Sciophila thoracica Staeger, 1840
Malaise sample 16.v – 19.vi.1997, one male and 19.vi – 18.vii.1997, four males. See discussion below. It has been reared from the bolete *Suillus luteus*.

Discussion

Of the species recorded most were common or widespread in Britain, but a few were of particular interest. Most curious was the find of one male of *Clastobasis alternans* in the Malaise trap. This species was only recently first recorded in Britain and is now known from four other sites scattered in England north to Yorkshire, all of them more or less wooded wetlands (Chandler, 2001). Its occurrence in the absence of any comparable habitat is therefore surprising and it is even difficult to believe that it could have been a vagrant. *Sciophila parviareolata* has also been recently recognised as a British species (Chandler, 2001), but it has previously been confused with the commoner species *S. hirta* Meigen. While *hirta* has been reared from a wide range of fungi growing on wood, no rearing record of *parviareolata* has yet been established; curiously most of the British records are of specimens taken at windows indoors, including two national museums and the records from the Garden are the first in Britain since 1936.

Two other uncommon species were also recorded during the survey. *Sceptonia flavipuncta* has been recorded from ten sites in southern England and Wales, mostly in recent years. *Sciophila thoracica* was first found in Britain in 1974 and was described as *S. quadriterga* by Hutson (1979), but synonymised with *thoracica* Staeger following examination of types by Chandler (2001). It has also been recorded previously from ten sites in southern England and Wales.

Of the 56 species recorded, 23 (including *Bolitophila* and the 15 Exechiini) are known or likely to be associated mainly with terrestrial fungi (although gill fungus feeders may also develop in those growing on wood) and 12 develop in polypores or encrusting fungi on wood. The two *Platurocypta* species develop in myxomycetes (also living on rotten wood) and *Docosia fumosa* is a regular inhabitant of birds' nests. Most of the Keroplatidae are predaceous web spinners on fungi, dead wood or other substrates as larvae. The biology of the genera *Clastobasis*, *Sceptonia* and *Zygomyia* is unknown. The two latter genera include several common species and are unlikely to be fungus feeders; the adults of *Sceptonia* are mainly found on tree foliage.

The composition of the fungus gnat fauna reflects the available habitats and not surprisingly most species were recorded in low numbers. Several of the species found more commonly in the Garden are very polyphagous (i.e. having a wide range of fungus hosts) and are thus able to take advantage of available fungi, even under unfavourable conditions. While a good range of fungi are recorded in the garden, there was a lack of habitat for those associated with dead wood. It was understood that control measures, using a fungicide, are taken against fairy rings on the lawns and caps of the honey fungus *Armillaria mellea* were removed by garden staff during one of the author's visits. As suggested elsewhere in this volume retention of more dead wood, especially in shaded situations, would benefit both fungi and the insects developing in them.

Acknowledgements

I am grateful to Colin Plant for inviting me to participate in this survey and for providing the relevant part of the Malaise trap catches. I am also indebted to Mark Lane, the Head Gardener at the Palace, for enabling me to make visits to the Garden and for the assistance of various members of his staff who accompanied me on these visits.

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Non-biting midges (Diptera: Chironomidae) in Buckingham Palace Garden

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Abstract

Over the years 1995 to 1998, 60 species of non-biting midge (Diptera: Chironomidae) were collected in Buckingham Palace Garden using a Malaise trap on The Mound and by sweeping vegetation. Four further species were recorded in the earlier survey (1961–1963), bringing the total for the Garden to 64. An annotated list is provided. The habitats within the Garden would be expected to generate such a spectrum of 'terrestrial' and aquatic species.

Introduction and origin of specimens

In the account of the previous survey of the natural history of Buckingham Palace Garden (1961 to 1963), Paul Freeman (in Richards, 1964) listed six species of chironomid obtained by light trapping. This is a remarkably small number for a large garden with a substantial shallow lake and damp organically enriched soil, particularly for a group of flies that is attracted to light in large numbers. Three further species were recorded from 'leaves by lake' making nine in total. It appears that the chironomids were occasional by-products of collecting other insects. Strangely, the three species collected from leaves by the lake were not collected in this survey.

Most of the material that arrived for identification in this survey was collected in a Malaise trap operated on The Mound between 7 May 1995 and 18 August 1997; further material was collected by D. J.Carter at a light trap and by P. J. Chandler sweeping vegetation with a net.

Results

The list below records a total of 64 species for the Garden; notes on phenology, larval habitat and distribution are appended: it is to be assumed that the specimens originated from The Mound (trapped or swept) unless otherwise stated. All the species are frequent to common and generally widespread in lowland Britain.

Annotated list of non-biting midges (Diptera: Chironomidae) recorded in Buckingham Palace Garden

The arrangement of taxa follows that of Chandler (1998). Species found only in the earlier survey are enclosed in round brackets. Taxa found in both surveys are indicated with an asterisk (*). Taxa found for the first time in this survey are unmarked.

CHIRONOMIDAE

CHIRONOMINAE

Chironomini

Larvae of the recorded species are either herbivorous or detritus feeders, living in shallow stagnant water.

Chironomus (Camptochironomus) pallidivittatus (Malloch, 1915)
Light trap 15 June 1995.

Chironomus (Camptochironomus) tentans Fabricius, 1805
Malaise trap June–August; 1995, 1996. Recorded by Paul Freeman for May in the earlier survey.

Chironomus (Chironomus) annularius auctt.
Malaise and light traps April, June–November; 1995, 1996, 1998. Particularly associated with small water bodies such as water butts.

Chironomus (Chironomus) cingulatus Meigen, 1830
Malaise trap June 1996.

Chironomus (Chironomus) commutatus Keyl, 1960
Swept in the 'northern fringes' on 26.vi.1998.

Chironomus (Chironomus) dorsalis auctt.
Swept on The Mound on 26.vi.1998. Breeds mainly in very shallow pools.

Chironomus (Chironomus) luridus Strenzke, 1959
Malaise trap January, February, April, June–November; 1996–1997. Characteristic of shaded stagnant water.

Chironomus (Chironomus) nuditarsis Keyl, 1961
Malaise trap April/May 1997.

Chironomus (Chironomus) piger Strenzke, 1959
Malaise trap September/October 1996.

* *Chironomus (Chironomus) plumosus* (Linnaeus, 1758)
Malaise trap April, June–November; 1995–1998; light trap30.vi.1995. Adults also swept from the Island and 'shrubby areas'. Recorded by Paul Freeman for September in the earlier survey. Breeds in lakes; larvae in mud.

Chironomus (Chironomus) prasinus Meigen, 1804
Malaise trap October 1996.

Chironomus (Chironomus.) riparius Meigen, 1804
Malaise trap May 1996. The larvae are poor at competing with other *Chironomus* species but are able to survive very low oxygen levels and so are characteristic of highly organically polluted waters. The species is, however, opportunistic and it is frequently found in new habitats, e.g. a bucket that is left outside and fills with rainwater.

Cladopelma krusemani (Goetghebuer, 1935)
Light trap 20.vii.1995.

Cladopelma virescens (Meigen, 1818)
Malaise trap April/May 1997.

(*Cryptochironomus supplicans* (Meigen, 1830))
Not recorded in the present survey but recorded by Paul Freeman in the earlier survey for October.

Dicrotendipes nervosus (Staeger, 1839)
Malaise trap April – November; 1995–1997; light trap 20.vii.1995. Adults common all over the garden in 1997–1998.

Dicrotendipes objectans (Walker, 1856)
Malaise trap September–October; 1995 and 1996.

Einfeldia pagana (Meigen, 1838)
Malaise trap June 1996.

Endochironomus tendens (Fabricius, 1775)
Malaise trap August–October; 1995, 1996. The larva mines the leaves of submerged broad-leaved macrophytes.

Glyptotendipes (Glyptotendipes) glaucus (Meigen, 1818)
Malaise trap May–October; light trap 6.vi and 22.ix.1995. Adults were also swept in the 'northern fringes' in 1998. Larvae frequently mine submerged macrophyllous plants.

Glyptotendipes (Glyptotendipes) pallens (Meigen, 1804)
Malaise trap March, April, June–October; light trap 1.vi.995. Also collected on the Island in 1998. Larvae may mine submerged leaves of aquatic plants.

Microchironomus tener (Kieffer, 1918)
Malaise trap June, August; 1995, 1996.

Microtendipes chloris (Meigen, 1818)
Malaise trap February, March, June, July, September, October; 1996, 1997.

Microtendipes pedellus (De Geer, 1776)
Malaise trap April–October; 1995–1997. Adults collected all over the Garden in 1997– 1998.

Parachironomus arcuatus (Goetghebuer, 1919)
Malaise trap February–November; 1995–1997. Light trap 13.vii.1995.

Parachironomus frequens (Johannsen, 1905)
Malaise trap June–July 1996. Also swept on the Island on 26.vi.1998.

(*Parachironomus monochromus* (van der Wulp, 1874))
Not encountered in this survey but recorded by Paul Freeman in the earlier survey for May 'on leaves by lake'.

Polypedilum (Pentapedilum) sordens (van der Wulp, 1874)
Malaise trap July/August 1997.

Polypedilum (Polypedilum) acutum Kieffer, 1915
Malaise trap September/October 1995.

* *Polypedilum (Polypedilum) nubeculosum* (Meigen, 1804)
Malaise trap February–October; 1995–1997. Adults collected all over the Garden in 1997 – 1998. Paul Freeman recorded the species in the earlier survey for June and September.

Polypedilum (Polypedilum) pedestre (Meigen, 1830)
Malaise trap April 1996.

Polypedilum (Tripodura) scalaenum (Schrank, 1803)
Malaise trap April–September; 1995–1997.

Tanytarsini

Larvae feed mainly on microphytes and debris.

(*Micropsectra junci* (Meigen, 1818))
Not encountered in this survey but recorded by Paul Freeman in the earlier survey for May 'on leaves by lake'. Breeds characteristically in seepages.

Paratanytarsus dissimilis (Johannsen, 1905)
Light trap on 15.vi and 20.vii.1995. Also swept on the Island on 26.vi.1998. Breeds in shallow, stagnant or running water.

(*Paratanytarsus laetipes* (Zetterstedt, 1850))
Recorded by Paul Freeman for May 'on leaves by lake', but not encountered in this survey.

Tanytarsus eminulus (Walker, 1856)
Malaise trap June, September; 1995, 1996. Larvae in shallow, stagnant or running water.

Tanytarsus mendax Kieffer, 1925
Malaise and light traps May–October; 1995–1997. Swept also from the Island in 1998. Breeds in the shallow water of lakes.

Tanytarsus usmaensis Pagast, 1931
Malaise trap April, May, August; 1995, 1996. Larvae in shallow water, mainly stagnant.

ORTHOCLADIINAE

The larvae are detritivores or herbivores.

Bryophaenocladius aestivus (Brundin, 1947)
Malaise trap May, July; 1995. Terrestrial; probably breeding in damp humus-rich soil.

Bryophaenocladius ictericus (Meigen, 1830)
Malaise trap July–October; 1995–1997. Adults collected also in 'shrubby areas near edge' in 1997. Breeds in moss away from the soil.

Bryophaenocladius nidorum (Edwards, 1929)
Malaise trap June 1995. Breeds in birds' nests (Edwards, 1929) and moss on roofs (Strenzke, 1952).

Bryophaenocladius vernalis (Goetghebuer, 1921)
Malaise trap June/July 1997. Breeds in wet soil (Fittkau quoted in Lehmann, 1971)

Cricotopus (Cricotopus) annulator Goetghebuer, 1927
Malaise and light traps May, June; 1995, 1996. Larvae in stagnant and flowing water.

Cricotopus (Cricotopus) bicinctus (Meigen, 1818)
Malaise and light traps May–October; 1995–1997 and swept on The Mound in 1998. Breeds in stagnant and flowing water.

Cricotopus (Cricotopus) similis Goetghebuer, 1921
Malaise trap October/November 1996. Larvae in stagnant and flowing water.

Cricotopus (Isocladius) intersectus (Staeger, 1839)
Malaise trap March/April 1996. Breeds in shallow stagnant water lakes and slow flowing water; larvae in submerged moss and on other macrophytes.

Cricotopus (Isocladius) sylvestris (Fabricius, 1794)
Malaise trap March–August; 1995–1997. Breeds mainly in stagnant water; larvae usually close to the water surface in filamentous algae or on macrophytes.

Limnophyes natalensis (Kieffer, 1914)
Malaise trap May 1995. Larvae are found in wet moss and leaf litter.

Limnophyes paludis Armitage, 1985
Malaise trap May, July–October; 1995–1997. More aquatic than most *Limnophyes* species, the larvae feeding on submerged dying grass leaves.

Metriocnemus eurynotus (Holmgren, 1883)
Malaise trap January/February 1997. A particularly abundant and widespread species in the early part of the year; larvae in floating filamentous algae and in wet moss.

Metriocnemus fuscipes (Meigen, 1818)
Malaise trap January–June; 1996, 1997. Larvae in damp moss on the ground.

Metriocnemus picipes (Meigen, 1818)
Malaise trap September/October 1995. Stagnant water (Spärck, 1922).

Paratrichocladius rufiventris (Meigen, 1830)
Malaise trap May–June 1996. Adults also swept in the 'northern fringes' on 26.vi.1998. Larvae on submerged macrophytes and in debris in stagnant and flowing water.

Smittia aterrima (Meigen, 1818)
Malaise and light traps October–March, June; 1995–1997. Larvae in damp soil.

Smittia pratorum (Goetghebuer, 1927)
Malaise trap September 1995. Larvae in soil; known to attack *Narcissus* bulbs (Edwards, 1929).

TANYPODINAE

The larvae are to a greater or lesser extent predators, small chironomid larvae often forming a large proportion of their diet. All the species recorded here breed in shallow stagnant water.

Macropelopiini

Psectrotanypus (Psectrotanypus) varius (Fabricius, 1787)
Malaise trap March–July; 1995–1997.

Pentaneurini

Ablabesmyia monilis (Linnaeus, 1758)
Malaise trap June, August; 1995, 1996.

Conchapelopia melanops (Meigen, 1818)
Malaise trap August 1995.

Procladiini

* *Procladius (Holotanypus) choreus* (Meigen, 1804)
Malaise and light traps March–July, October, November; 1995, 1996. Recorded for April, May and July in the earlier survey by Paul Freeman.

Procladius (Holotanypus) sagittalis (Kieffer, 1909)
Malaise trap February–October; 1995–1998.

Procladius (Psilotanypus) lugens Kieffer, 1915
Malaise trap March–June, August–October; 1995, 1996.

* *Procladius (Psilotanypus) rufovittatus* (van der Wulp, 1874)
Malaise and light traps July–September 1995. Recorded for July by Paul Freeman in the earlier survey.

Tanypodini

Tanypus punctipennis Meigen, 1818
Malaise trap April–November; 1995–1997. The most abundant species of Chironomidae in the Garden, also swept from the Island, lake margin and 'northern fringes' in 1997–1998.

Tanypus vilipennis (Kieffer, 1918)
Swept on The Mound on 26.vi.1998.

Discussion

No species restricted to running water or characteristic of deep water have been collected in the Garden: all the species recorded can breed within the confines of the Garden and its managed permanent habitats. The Malaise trap appears to have been particularly efficient in sampling the Chironomidae of the Garden. Only three species collected by sweeping vegetation (*Chironomus commutatus*, *Chironomus dorsalis* and *Tanypus vilipennis*) were not represented in Malaise or light trap collections. However, netted specimens were submitted from only four days (13 August, and 31 October 1997; 26 June and 1 October 1998), allowing speculation that a few species could have avoided collection by both methods. This could explain the apparent absence of the three species which were recorded for May 'on leaves by lake' in the earlier survey.

Acknowledgements

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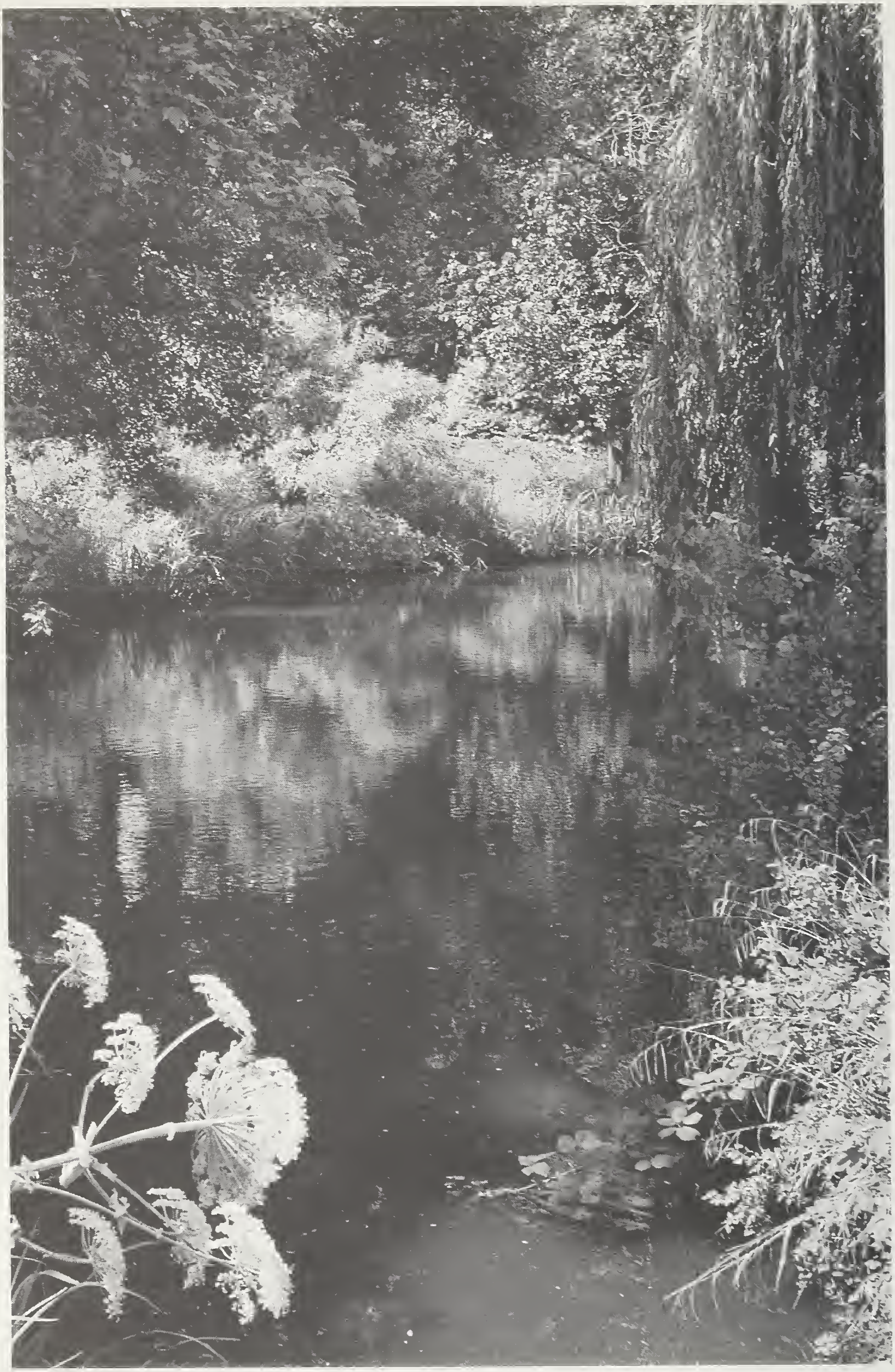

PLATE J. Buckingham Palace Garden, London. View of The Lake, adjacent to The Mound. Freshwater, especially with marginal vegetation, makes an important contribution to the overall ecology of urban sites. *Photographed © by Mark Lane*

Brachycera (Diptera) in Buckingham Palace Garden

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Abstract

Brachycera (Diptera) were sampled at Buckingham Palace Garden, using a Malaise trap operated continuously between 20 April 1995 and 18 August 1997. These collections were supplemented by active fieldwork during the period 1995 to 1998 by several entomologists. A total of 484 species was recorded. An earlier survey, carried out in the early 1960s recorded 68 species. Taken together, the two lists provide an overall total of 511 species of Brachycera in the Garden. All species are listed with brief notes.

Introduction and survey methods

An earlier survey at Buckingham Palace Garden (Richards 1964) recorded a total of 68 species of Brachyceran Diptera. As a part of the overall programme of resurvey, a single Malaise trap was operated continuously at a fixed position on The Mound, from 20 April 1995 to 18 August 1997 and Diptera from this were passed to me for naming. In addition to this passive trapping, active fieldwork was carried out in the garden. Colin Plant visited on many occasions during the years 1995 to 1998 and passed to me all of the Brachycera other than the Syrphidae and a few other smaller families. Peter Chandler visited the garden on five occasions during 1997 and 1998 and provided me with a full list of his captures.

Identification of material

Specimens from the Malaise trap were sorted by Colin Plant, who was also responsible for identifications of Rhagionidae, Tabanidae, Stratiomyidae, Bombyliidae, Asilidae and Syrphidae. Phoridae were identified by Henry Disney. Nigel Wyatt identified flies from a few of the Malaise trap samples and Adrian Plant was responsible for the identification of a few of the Empididae and Hybotidae. Peter Chandler named the samples that he himself had collected. All remaining material, comprising the bulk of the Malaise trap samples, was identified by the author.

Results

A complete list of the Brachycera recorded at Buckingham Palace Garden is presented below. Two families have been singled out for special treatment: the Phoridae are presented as a separate paper by Henry Disney and the Syrphidae are similarly treated by Colin Plant. Nevertheless, the species in these two families are included in the present list, without comment, in order that a single, complete list of Brachycera may be presented.

Within the list, Malaise trap records are indicated individually unless they exceed four. If a species was present in more than four collections then only the months in which it was taken are given. No attempt was made to note the relative abundance of each species in the collections; consequently 'a record' could consist of a few specimens to literally hundreds of individuals. In order to avoid cluttering up the list, records made during visits by Peter Chandler are coded by locality as follows:

A Partly wooded fringes from the offices up to the compost area and rose garden (all visits);
B Island in The Lake (all visits)
C Lake margin opposite the Palace (August visit only)
D Secondary woodland over rank grasses on The Mound (all visits)

An annotated list of the Brachycera (Diptera) recorded in Buckingham Palace Garden

The sequence and nomenclature in the list follow Chandler (1998) and the subsequent updates Chandler (1999 and 2000). Species found in the earlier survey (Richards 1964), but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey. The notes on larvae were mainly based on the information contained in Smith (1989).

RHAGIONIDAE

Chrysopilus asiliformis (Preyssler, 1791)
Malaise trap, 7 – 20.v.1995 and 20 – 27.vii.1995.

TABANIDAE

(*Haematopota pluvialis* (Linnaeus, 1758))
Recorded for June in the 1961 – 1963 survey. It was commented that the species breeds in damp ground and probably would be able to do so by the lake. It is considered unlikely that this would be possible today and the species is apparently absent.

STRATIOMYIDAE

BERIDINAE

Beris chalybata (Forster, 1771)
Malaise trap, 9 – 23.v.1996.

Beris vallata (Forster, 1771)
Malaise trap, 20.v. – 23.vi.1995, 23 – 30.vi.1995.

Chorisops nagatomii Rozkošný, 1979
Malaise trap, 24 – 31.viii.1995, 22.ix. – 28.x.1995, 15.viii.- 5.ix.1996, 5.ix. – 21.x.1996.

Chorisops tibialis (Meigen, 1820)
Malaise trap, present in nine collections, May – September. Several at flowers in the Silver Garden on 5.vii.1996.

PACHYGASTRINAE

Eupachygaster tarsalis (Zetterstedt, 1842)
A scarce species last recorded in the Greater London area almost a hundred years ago in Blackheath. Malaise trap, 23 – 30.vi.1995.

Pachygaster atra (Panzer, [1798])
Malaise trap, present in ten collections, May – September. Commonly found by sweeping or beating bushes on The Mound and in The Border.

Pachygaster leachii Stephens in Curtis, 1824
Malaise trap, present in nine collections, May – August. Commonly found by sweeping or beating bushes on The Mound and in The Border.

SARGINAE

Chloromyia formosa (Scopoli, 1763)
Malaise trap, 23 – 30.vi.1995. Surprisingly scarce. Three females netted in the area of the Fire Hole on 5.vii.1996 is the only record outside the Malaise trap of this usually abundant soldier fly.

Microchrysa polita (Linnaeus, 1758)
Malaise trap, 23 – 30.vi.1995, 3 – 10.viii.1995.

Sargus bipunctatus (Scopoli, 1763)
Malaise trap, 20.x. – 20.xi.1995.

BOMBYLIIDAE

Bombylius major Linnaeus, 1758

Malaise trap, 27.iii. – 24.iv.1997. Scarce, but occasionally seen at flower borders in the spring.

THEREVIDAE

Thereva nobilitata (Fabricius, 1775)

Malaise trap, present in eight collections, May – August.

ASILIDAE

ASILINAE

Machimus atricapillus (Fallén, 1814)

Malaise trap, 20 – 27.viii.1995, 18.vii. – 13.viii.1997.

STENOPOGONINAE

Dioctria baumhaueri Meigen, 1820

Malaise trap, present in seven collections, May – August. 26.vi.1998 and in sweep net samples from The Mound.

HYBOTIDAE

Small any mainly predacious, the species recorded are generally widespread and common. *Platypalpus aristatus* and *P. incertus* were listed as Notable by Falk (1991) but will be removed from that category in a forthcoming review. *Drapetis setiger* is uncommon and *Platypalpus biapicalis*, is a rare species added to the British list in 1988 (Drake 1988).

HYBOTINAE

Hybos culiciformis (Fabricius, 1775)

Taken at various points throughout the garden on 13.viii.1997.

Hybos femoratus (Muller, 1776)

Malaise trap, 10 – 17.viii.1995.

OCYDROMINAE

Ocydromia glabricula (Fallén, 1816)

Taken in the wooded area on 1.x.1998.

TACHYDROMIINAE

Crossopalpus nigritellus (Zetterstedt, 1842)

Malaise trap, 20 – 28.vii.1995.

Drapetis ephippiata (Fallén, 1815)

Malaise trap, present in ten collections, April, July – September and 20.xii.95-23.ii.96.

Drapetis exilis (Meigen, 1822)

Malaise trap 7 – 20.v.1995, 7 – 22.ix.1995. and one on a plane tree trunk in area A, 31.x.1997.

Drapetis setiger (Loew, 1859)

Malaise trap, 10 – 17.viii.1995.

Platypalpus annulipes (Meigen, 1822)

Malaise trap, 18 – 27.vi.1996.

Platypalpus aristatus (Collin, 1926)

Malaise trap, 18 – 27.vi.1996.

Platypalpus biapicalis Weber, 1972

Malaise trap, 20 – 28.vii.1995.

Platypalpus calceatus (Meigen, 1822)

Malaise trap, 20 – 28.vii.1995.

Platypalpus incertus (Collin, 1926)

Malaise trap, present in five collections, May – July.

(*Platypalpus longicornis* (Meigen, 1822))

* *Platypalpus longiseta* (Zetterstedt, 1842)
Recorded in the 1961 – 1963 survey as *P.extricatus.* Malaise trap up to 7.vii.1995, 20 – 28.vii.1995.

Platypalpus minutus (Meigen) *or P. australominutus* Grootert
One female in area D on 13.viii.1997 cannot be identified beyond the level of this species pair.

Platypalpus pallidiventris (Meigen, 1822)
Malaise trap, 7 – 20.v.1995.

Platypalpus verralli (Collin, 1926)
Malaise trap, 7 – 20.v.1995.

Tachypeza nubila (Meigen, 1804)
Malaise trap 31.viii – 7.ix.1995, 7 – 22.ix.1995, 22.ix – 30.x.1995 and on Plane trunks, 21.x.96 and 13.viii.1997.

EMPIDIDAE

Commonly referred to as dance flies, *Hilara* in particular often forming huge swarms over water, all these species are widespread.

EMPIDINAE

Empis aestiva Loew, 1867
Malaise trap, 7 – 20.v.1995, up to 7.vii.1995, and D, on 26.vi.1998.

Empis albinervis Meigen, 1822
Malaise trap, 7 – 20.v.1995, 20-28.vii.1995, up to 7.vii.1995 and D on 26.vi.1998.

Empis nuntia Meigen, 1838
Malaise trap, 18 – 27.vi.1996.

* *Empis praevia* Collin, 1927
Malaise trap, 23.v. – 6.vi.1996.

Empis tessellata Fabricius, 1794
Malaise trap, 23.v. – 6.vi.1996.

Empis tumida Meigen, 1822
Malaise trap, 20 – 28.vii.1995. 5.vii.1996, Silver Garden.

Hilara brevistyla Collin 1927
Malaise trap, 25.iv. – 9.v.1996.

(*Hilara flavipes* Meigen, 1822)

Hilara fuscipes (Fabricius, 1794)
Malaise trap, 7 – 20.v.1995, up to 30.vi.1995, up to 7.vii.1995 and D on 26.vi.1998.

Hilara griseifrons Collin 1927
Malaise trap, present in four collections, May – August.

Hilara manicata Meigen, 1822
Malaise trap, 7 – 20.v.1995.

Hilara monedula Collin, 1927
B (males) and D (female) on 26.vi.1998.

Hilara obscura Meigen, 1822
A and B, numerous on 26.vi.1998 and B on 13.viii.1997.

Rhamphomyia erythropthalma Meigen, 1830
Malaise trap, 7 – 22.ix.1995, 22.ix – 20.x.1996 and areas A and D on 1.x.1998.

Rhamphomyia gibba (Fallén, 1816)
Malaise trap, 3-10.viii.1995, 10-17.viii.1995, 18.vii-13.viii.1997. 13.viii.1997 B.

Rhamphomyia nigripennis (Fabricius, 1794)
B, on 26.vi.1998.

Rhamphomyia tarsata Meigen, 1822
Malaise trap, up to 7.vii.1995, and D on 26.vi.1998.

HEMERODROMIINAE

(*Hemerodromia raptoria* Meigen, 1830)

DOLICHOPODIDAE

Mostly predatory species often with striking metallic coloration and or leg adornments. All these species are common and widespread.

DIAPHORINAE

Argyra argyria (Meigen, 1824)
B, on 26.vi.1998.

Chrysotus cupreus (Macquart, 1827)
Malaise trap, 20 – 28.vii.1995.

Chrysotus gramineus (Fallén, 1823)
Malaise trap, 7 – 20.v.1995 and B on 26.vi.1998.

DOLICHOPODINAE

Dolichopus griseipennis Stannius, 1831
Malaise trap, present in seven collections, June, July – September. 13.viii.1997 A B.

Dolichopus ungulatus (Linnaeus, 1758)
Malaise trap, 7 – 20.v.1995, up to 30.vi.1995, up to 7.vii.1995, 20-28.vii.1995. Also in the Silver Garden, 5.vii.1996 and areas B (26.vi.1998) and C (13.viii.1997).

Poecilobothrus nobilitatus (Linnaeus, 1767)
Malaise trap, up to 30.vi.1995, 7 – 20.v.1995. 26.vi.1998 B numerous.

HYDROPHORINAE

Hydrophorus litoreus Fallén, 1823
15.vi.1995, light trap.

MEDETERINAE

* *Medetera jacula* (Fallén, 1823)
Malaise trap, present in five collections, May, July, August.

Medetera truncorum Meigen, 1824
Malaise trap, present in four collections, July, August. Also areas A and B on 26.vi.1998 and B (on tree trunks) on 13.viii.1997.

SCIAPODINAE

Sciapus wiedemanni (Fallén, 1823)
Malaise trap, 20 – 28.vii.1995.

Sciapus platypterus (Fabricius, 1805)
Malaise trap, present in five collections, May – August and also in A, B and D on 26.vi.1998, mostly on tree trunks.

SYMPYCNINAE

Anepsiomyia flaviventris (Meigen, 1824)
Area D, on 26.vi.1998.

Campsicnemus curvipes (Fallén, 1823)
Area A, on 19.x.1998, and Area D, on31.x.1997.

* *Sympycnus desoutteri* Parent, 1925
Areas A, B, C and D on 13.viii.1997.

Syntormon denticulatum (Zetterstedt, 1843)
Area B, on 31.x.1997, 26.vi.1998 and 1.x.1998.

(*Syntormon pallipes* (Fabricius, 1794))

PLATYPEZIDAE

The six species recorded are all fungus feeders as larvae. The *Agathomyia* and *Polyporivora* species develop in bracket fungi, *Lindneromyia* in field mushrooms (*Agaricus* species) and the species of *Platypeza* and *Protoclythia* in the honey fungus *Armillaria mellea*, on which they were recorded. All are widespread except *A. falleni*, which is local and confined to the south-east of England.

CALLOMYIINAE

Agathomyia antennata (Zetterstedt, 1819)
Area A, 1.x.1998.

Agathomyia falleni (Zetterstedt, 1819)
Malaise trap, 22.ix – 20.x.1996 and a female on hazel foliage near Malaise trapon 1.x.1998.

PLATYPEZINAE

Lindneromyia dorsalis (Meigen, 1804)
Malaise trap, 7 – 22.ix.1995.

Platypeza consobrina Zetterstedt, 1844
1.x.1998. on *Armillaria mellea*, and one in area A on 19.x.1998.

Polyporivora picta (Meigen, 1830)
Malaise trap, 21.x – 28.xi.1996, 18.vii – 13.viii.1997.

Protoclythia rufa (Meigen, 1830)
Malaise trap, 22.ix – 20.x.1996, 20.x – 20.xi.1996 and one on fungus *Armillaria mellea* in area A on1.x.1998.

PHORIDAE

Anevrina thoracica (Meigen, 1804) *Conicera dauci* (Meigen, 1830)
C. similis (Haliday, 1833)
Diplonevra funebris (Meigen, 1830)
D. nitidula (Meigen, 1830)
D. pilosella Schmitz, 1927
Dohrniphora cornuta (Bigot, 1857)
Gymnoptera vitripennis (Meigen, 1830)
Megaselia aculeata (Schmitz, 1919) *M. aequalis* (Wood, 1909)
M. albicaudata (Wood, 1910)
M. altifrons (Wood, 1909)
M. angusta (Wood, 1909)
M. basispinata (Lundbeck, 1920)
M. berndseni (Schmitz, 1919)
M. bovista (Gimmerthal, 1848)
M. brevicostalis (Wood, 1910)
M. ciliata (Zetterstedt, 1848)
M. cinereifrons (Strobl, 1910)
M. clemonsi Disney, 1984
M. consetigera (Schmitz, 1925)
M. densior Schmitz, 1927
M. devia Schmitz, 1936
M. drakei Disney, 1984
M. emarginata (Wood, 1908)
M. errata (Wood, 1912)
M. feshiensis Disney, 1987
M. flava (Fallén, 1823)
M. frameata Schmitz, 1927
M. giraudii (Egger, 1862)
M. gregaria (Wood, 1910)
M. hendersoni Disney, 1979
M. hirtiventris (Wood, 1909)
M. ignobilis (Schmitz, 1919)

M. infraposita (Wood, 1909)
M. latior Schmitz, 1936
M. longicostalis (Wood, 1912)
M. manicata (Wood, 1910)
M. marklanei Disney, 2001
M. meconicera (Speiser, 1925)
M. minor (Zetterstedt, 1848)
M. nigra (Meigen, 1830)
M. nigriceps (Loew, 1866)
M. paludosa (Wood, 1908)
M. pectoralis (Wood, 1910)
M. pleuralis (Wood, 1909)
M. plurispinulosa (Zetterstedt, 1860)
M. propinqua (Wood, 1909)
M. pumila (Meigen, 1830)
M. pusilla (Meigen, 1830)
M. quadriseta (Schmitz, 1918)
M. rubella (Schmitz, 1920)
M. ruficornis (Meigen, 1830)
M. rufipes (Meigen, 1804)
M. spinicincta (Wood, 1910)
M. stichata (Lundbeck, 1920)
M. stigmatica (Schmitz, 1920)
M. subcarpalis (Lundbeck, 1920)
M. subpleuralis (Wood, 1909)
M. sulphuripes (Meigen, 1830)
M. superciliata (Wood, 1910)
M. surdifrons (Wood, 1909)
M. sylvatica (Wood, 1910)
M. tarsalis (Wood, 1910)
Metopina galeata (Haliday, 1833)
M. oligoneura (Mik, 1867)
M. pileata Schmitz, 1936
M. ulrichi Disney, 1979
Phalacrotophora fasciata (Fallén, 1823) **Phora atra* (Meigen, 1804)
Recorded in the 1961 – 1963 survey as *P. aterrima.*
P. holosericea Schmitz, 1920
Pseudacteon formicarum (Verrall, 1877)
Spiniphora bergenstammi (Mik, 1864)
Triphleba distinguenda (Strobl, 1892)
T. nudipalpis (Becker, 1901)

LONCHOPTERIDAE
* *Lonchoptera lutea* Panzer, 1809
Malaise trap, present in four collections, July – October. 1.x.1998 A, 19.x.1998 A.

SYRPHIDAE
SYRPHINAE
BACCHINI
Baccha elongata (Fabricius, 1775)
Melanostoma mellinum (Linnaeus, 1758)

Melanostoma scalare (Fabricius, 1794)
⋆ *Platycheirus albimanus* (Fabricius, 1781)
(*Platycheirus clypeatus* agg.)
Platycheirus scutatus (Meigen, 1822)
Platycheirus rosarum (Fabricius, 1787)

SYRPHINI
Chrysotoxum bicinctum (Linnaeus, 1758)
Dasysyrphus albostriatus (Fallén, 1817)
Dasysyrphus venustus (Meigen, 1822)
Epistrophe eligans (Harris, [1780])
⋆ *Episyrphus balteatus* (De Geer, 1776)
Eupeodes corollae (Fabricius, 1794)
Eupeodes luniger (Meigen, 1822)
Meligramma trianguliferum (Zetterstedt, 1843)
⋆ *Meliscaeva auricollis* (Meigen, 1822)
Scaeva pyrastri (Linnaeus, 1758)
(*Sphaerophoria rueppellii* (Wiedemann, 1830))
Sphaerophoria scripta (Linnaeus, 1758)
⋆ *Syrphus ribesii* (Linnaeus, 1758)
Syrphus torvus Osten Sacken, 1875
Syrphus vitripennis Meigen, 1822
Xanthogramma pedissequum (Harris, [1776])

MILESIINAE
CHEILOSIINI
Cheilosia pagana (Meigen, 1822)

CHRYSOGASTRINI
Neoascia podagrica (Fabricius, 1775)

ERISTALINI
Eristalis (Eoseristalis) intricarius (Linnaeus, 1758)
⋆ *Eristalis (Eristalis) tenax* (Linnaeus, 1758)
Helophilus pendulus (Linnaeus, 1758)
Myathropa florea (Linnaeus, 1758)

MERODONTINI
Eumerus ornatus Meigen, 1822
Eumerus strigatus (Fallén, 1817)
Eumerus funeralis Meigen, 1822 (= tuberculatus Rondani, 1857)
Merodon equestris (Fabricius, 1794)

PIPIZINI
Heringia (Neocnemodon) vitripennis (Meigen, 1822)

VOLUCELLINI
Volucella inanis (Linnaeus, 1758)
Volucella pellucens (Linnaeus, 1758)
Volucella zonaria (Poda, 1761)

XYLOTINI
Syritta pipiens (Linnaeus, 1758)
Xylota segnis (Linnaeus, 1758)

PIPUNCULIDAE

CHALARINAE

* *Chalarus spurius* (Fallén, 1816)
Recorded as "*spurius* agg" in the 1961 – 1963 survey.

PIPUNCULINAE

Cephalops ultimus (Becker, 1900)
Malaise trap, 30.vi.1995, 18.viim– 13.viii.1995.

Eudorylas obliquus Coe, 1966
Malaise trap, present in five collections, June, July, September – November. Swept in area D on 1.x.1998.

Pipunculus campestris Latreille, 1802
Malaise trap, 31.viii. – 7.ix.1995 and area A on 26.vi.1998.

PSILIDAE

Both recorded species are common and widespread. *Chamaepsila rosae*, the carrot fly, is a significant pest.

PSILINAE

Psila merdaria Collin, 1944
Malaise trap, 23.v. – 6.vi.1996, 15.v. – 19.vi.1997.

Chamaepsila rosae (Fabricius, 1794)
A male on the island on 13.viii.1997 and a probable female in area A on 31.x.1997.

LONCHAEIDAE

Small, shiny blue/black insects, larvae often found beneath the bark of trees. *Lonchaea palposa* is listed as Notable by Falk (1991).

LONCHAEINAE

Lonchaea chorea (Fabricius, 1781)
Areas A, B and D on 26.vi.1998 and rea B on 1.x.1998.

Lonchaea laticornis Meigen, 1826
One female in D on 26.vi.1998.

Lonchaea palposa Zetterstedt, 1847
Malaise trap, 17 – 24.viii.1995.

Protearomyia nigra (Meigen, 1826)
Malaise trap, 18 – 27.vi.1996.

Setisquamalonchaea fumosa (Egger, 1862)
Malaise trap, present in seven collections, May – September. On dead wood of *Robinia* trunk in area B on13.viii.1997.

PALLOPTERIDAE

One of the smaller families of picture winged flies, all widespread species.

PALLOPTERINAE

Palloptera muliebris (Harris, [1780])
Malaise trap, present in six collections, May, August – October.

Palloptera umbellatorum (Fabricius, 1775)
Malaise trap, present in eight collections, May – October. Also in areas A and D on 26.vi.1998, area C on 13.viii.1997 and area B on 1.x.1998.

Palloptera ustulata Fallén, 1820
Malaise trap, 7 – 22.ix.1995.

PIOPHILIDAE

Both recorded species are common and widespread.

PIOPHILINAE

Liopiophila varipes (Meigen, 1830)
Area A, on13.viii.1997.

* *Parapiophila vulgaris* (Fallén, 1820)
Area D, on 1.x.1998, attracted in large numbers by decomposing contents of Malaise trap bottle.

Ulidiidae

Otitinae

Seioptera vibrans (Linnaeus, 1758)
Malaise trap, 15.v – 19.vi.1997.

Tephritidae

The picture-winged flies. None of these records are surprising.

TEPHRITINAE

Chaetostomella cylindrica (Robineau-Desvoidy, 1830)
Area B, on 26.vi.1998.

Tephritis formosa (Loew, 1844)
Malaise trap, up to 30.vi.1995 and area D on 13.viii.1997.

Tephritis vespertina (Loew, 1844)
Silver Garden, 5.vii.1996 and area D on 31.x.1997.

(*Urophora cardui* (Linnaeus, 1758))

Xyphosia miliaria (Schrank, 1781)
Malaise trap, present in four collections, May – August.

TRYPETINAE

Trypeta zoe Meigen, 1826
Malaise trap, 20 – 28.vii.1995, 7 – 22.ix.1995 and areas B and C on 1.x.1998.

LAUXANIIDAE

Mainly woodland species, many are known to develop in decaying vegetation. Three species listed here *Homoneura tesque, Aulagastromyia anisodactyla* and *Sapromyza quadricincta* are categorised by Falk (1991) as Notable, although *A. anisodactyla* is recorded from nine sites in south-west Essex and East London.

HOMONEURINAE

Homoneura patelliformis (Becker, 1895)
Malaise trap, 7 – 20.v.1995, up to 7.vii.1995. Silver Garden, 5.vii.1996. Two males in area D on 26.vi.1998. .

Homoneura tesquae (Becker, 1895)
Malaise trap, 3 – 10.viii.1995.

Homoneura tesquae (Becker, 1895) or *christophi* (Becker, 1895)
One female in D on 13.viii.1997.

LAUXANIINAE

Aulagastromyia anisodactyla (Loew, 1845)
Malaise trap, present in five collections, July – September and in D on 13.viii.1997 and 26.vi.1998.

Calliopum aeneum (Fallén, 1820)
Area D on 26.vi.1998 and areas B and D on 13.viii.1997.

Calliopum simillimum (Collin, 1933)
Malaise trap, 31.viii – 7.ix.1995, 7 – 22.ix.1995, 21.x. – 28.xi.1996. Also in area B on 1.x.1998.

Meiosimyza decempunctata (Fallén, 1820)
Malaise trap, 7 – 20.v.1995.

Meiosimyza rorida (Fallén, 1820)
Malaise trap, 27.vii – 3.viii.1995. Area D on 13.viii.1997 and 26.vi.1998.

Pseudolyciella stylata Papp, 1978
Malaise trap, up to 30.vi.1995.

Minettia inusta (Meigen, 1826)
Malaise trap, present in five collections, May, July, August. Also in areas B and C on 13.viii.1997 and one on a plane trunk in area A on 26.vi.1998.

Minettia longipennis (Fabricius, 1794)
Malaise trap, up to 30.vi.1995.

Minettia lupulina (Fabricius, 1787)
Silver Garden, 5.vii.1996 and aread D on 13.viii.1997.

Minettia rivosa (Meigen, 1826)
Malaise trap, present in eight collections, May – September. Silver Garden, 5.vii.1996, area D on 13.viii.1997 and in areas B and D on 26.vi.1998.

Sapromyza quadricincta Becker, 1895
Malaise trap, 20 – 28.vii.1995.

Sapromyza quadripunctata (Linnaeus, 1767)
Malaise trap, 3 – 10.viii.1995, 31.viii – 7.ix.1995, 18-27.vi.1996.

Sapromyza halidayi Shatalkin, 2000 (=*sordida* Haliday, 1833, preocc)
Malaise trap, present in nine collections, May – November. Also in the Silver Garden on 5.vii.1996, areas A, C and D on 13.viii.1997, area B on 31.x.1997, area D on 26.vi.1998 and areas Band D on 1.x.1998.

Tricholauxania praeusta (Fallén, 1820)
Malaise trap, 20 – 28.vii.1995, 3 – 10.viii.1995, 7 – 22.ix.1995. Also in area D on 26.vi.1998.

CHAMAEMYIIDAE

The larvae are predators of aphids and coccids.

CHAMAEMYIINAE

Chamaemyia polystigma (Meigen, 1830)
Malaise trap, 10 – 17.viii.1995. In grassy area on The Mound on 13.viii.1997.

(*Leucopis puncticornis* Meigen, 1830)

DRYOMYZIDAE

Not uncommon; has been reared from dung.

Dryomyza flaveola (Fabricius, 1794)
Area A on 13.viii.1997.

SCIOMYZIDAE

Sciomyzid larvae feed on terrestrial or aquatic molluscs. *Sepedon* is a predator of aquatic molluscs, but the larval habits of *Trypetoptera*, which is often found in woodland, are unknown.

SCIOMYZINAE

Sepedon sphegea (Fabricius, 1775)
Area C on 13.viii.1997 and 1.x.1998.

Trypetoptera punctulata (Scopoli, 1763)
Malaise trap, 20-28.vii.1995 and in aread D on 13.viii.1997 and 26.vi.1998.

SEPSIDAE

All these species develop in various animal faeces; *Themira superba* is the most noteworthy amongst a group of widespread species.

Nemopoda nitidula (Fallén, 1820)
Area B on 1.x.1998.

Sepsis cynipsea (Linnaeus, 1758)
Malaise trap, 7 – 20.v.1995.

Sepsis fulgens Meigen, 1826
Malaise trap, 31.viii. – 7.ix.1995, 7 – 22.ix.1995, 22.ix. – 20.x.1996. Also in area A on 31.x.1997 and area D on 13.viii.1997.

Sepsis orthocnemis Frey, 1908
Malaise trap, 20 – 28.vii.1995. Area D on 13.viii.1997.

Sepsis punctum (Fabricius, 1794)
Area A on 13.viii.1997 and 31.x.1997.

Sepsis violacea Meigen, 1826
Malaise trap, 25.iv. – 9.v.1996.

Themira annulipes (Meigen, 1826)
Area B on 26.vi.1998.

Themira lucida (Staeger, 1844)
Area B on 26.vi.1998 and areas B and C on 13.viii.1997.

Themira superba (Haliday, 1833)
Area A on26.vi.1998.

CLUSIIDAE

Two common species whose larvae develop in dead wood.

Clusiodes albimanus (Meigen, 1830)
Malaise trap, 7 – 20.v.1995, 7 – 22.ix.1995, 21.x.1996.

Clusiodes gentilis (Collin 1912)
Malaise trap, 7 – 22.ix.1995.

ODINIIDAE

Probably the most frequently encountered member of the genus, I have collected it regularly on fungi on old Beech trees.

Odinia boletina (Zetterstedt, 1848)
Malaise trap, 7 – 20.v.1995.

AGROMYZIDAE

All agromyzids are plant feeders; about seventy five percent are leaf miners, the rest feeding in stems or roots.

AGROMYZINAE

(*Agromyza alnibetulae* Hendel, 1931)

(*Agromyza demeijerei* Hendel, 1920)

Agromyza flavipennis Hendel, 1920
Malaise trap, 25.iv. – 9.v.1996.

Agromyza mobilis Meigen, 1830
Malaise trap, 7 – 20.v.1995.

(*Agromyza nigripes* Meigen, 1830)

Agromyza nigrociliata Hendel, 1931
Malaise trap, 25.iv. –.v.1996.

Agromyza reptans Fallén, 1823
Area B on 26.vi.1998.

PHYTOMYZINAE

Cerodontha biseta (Hendel, 1920)
Malaise trap, up to 7.vii.1995. Area D on 26.vi.1998.

(*Cerodontha denticornis* (Panzer, [1806]))

Cerodontha fulvipes (Meigen, 1830)
Area D on 13.viii.1997.

Cerodontha iraeos (Robineau-Desvoidy, 1851)
Mines in *Iris pseudacorus*, 1997/8

(Cerodontha pygmaea (Meigen, 1830))
Recorded in the 1961 – 1963 survey as *Poemyza pygmaea* (R-D)

(Chromatomyia horticola (Goureau, 1851))
Recorded in the 1961 – 1963 survey as *Phytomyza atricornis.*

Chromatomyia milii (Kaltenbach 1864)
Malaise trap, 7 – 20.v.1995. Areas A and B on 26.vi.1998.

(Liriomyza centaureae Hering, 1927*)*

(Liriomyza congesta (Becker, 1903))

Liriomyza demeijerei Hering, 1930
Malaise trap, 20 – 28.vii.1995.

Liriomyza flaveola (Fallén, 1823)
Area A on 31.x.1997.

(Liriomyza strigata (Meigen, 1830))

Napomyza lateralis (Fallen, 1823)
Malaise trap, 22.ix. – 20.x.1995.

(Phytomyza aconiti Hendel, 1920)

(Phytomyza affinis Fallen, 1823)

Phytomyza aquilegiae Hardy, 1849.
Mines on *Aquilegia* 1997/8.

* *Phytomyza chaerophylli* Kaltenbach 1856
Recorded in the 1961 – 1963 survey as *Phytomyza anthrisci.* Malaise trap, 18 – 27.vi.1996.

(Phytomyza cytisi Brischke, 1881*)*

* *Phytomyza ilicis* Curtis, 1846
Mines on various dates.

(Phytomyza lappae Goureau, 1851*)*
Recorded in the 1961 – 1963 survey as *Phytomyza lappinae.*

Phytomyza pastinacae Hendel
Area B on 13.viii.1997.

Phytomyza ranunculi (Schrank, 1803)
Malaise trap, up to 7.vii.1995, 20 – 28.vii.1995.

(Phytomyza spondylii Robineau-Desvoidy*).*
Recorded in the 1961 – 1963 survey as *P. sphondylii.*

OPOMYZIDAE

These three species are all common. The larvae develop in grasses and cereals.

Geomyza tripunctata Fallen, 1823
Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995, 7 – 22.ix.1995. 28.iii. – 11.iv.1996.

Opomyza florum (Fabricius, 1794)
Malaise trap, present in four collections, August – November. Areas A, C and D on 13.viii.1997 and area A on 31.x.1997 and 1.x.1998.

Opomyza germinationis (Linnaeus, 1758)
Malaise trap, present in ten collections, May – October. Silver Garden area, 5.vii.1996. Also in area D on 13.viii.1997, areas A and D on 26.vi.1998 and in area B on 1.x.1998.

PERISCELIDAE

A Nationally Notable species strongly associated with sap runs.

Periscelis annulata (Fallén, 1813)
Malaise trap, 20.v – 19.vi.1997.

ASTEIIDAE

Two widespread species; *Leiomyza* has been reared from fungi.

Asteia amoena Meigen, 1830
Malaise trap, up to 7.vii.1995, 20 – 28.vii.95, >21.x.96, 18.vii – 13.viii.1997.

Leiomyza laevigata (Meigen, 1830)
Malaise trap, 18 – 27.vi.1996, up to 7.vii.1995. >21.x.96, 18.vii. – 13.viii.1997.

CARNIDAE

Tiny flies, many members of the genus Meoneura have been reared from birds' nests, whilst adults can often be found in numbers on flowers.

Meoneura minutissima (Zetterstedt, 1860)
Malaise trap, 10 – 17.viii.1995.

CHLOROPIDAE

A large family, primarily plant feeders but with a diverse range of larval habits. The species listed here are mostly widespread and most are grass or cereal feeders and some are significent agricultural pests. Both the *Tricimba* species have been reared from fungi. *Chlorops planifrons, Elachiptera austriaca,* and *Oscinimorpha arcuata* are all Notable.

CHLOROPINAE

Cetema elongatum (Meigen, 1830)
Malaise trap, 20 – 28.vii.1995.

Cetema neglectum Tonnoir, 1921
Malaise trap, 20 – 28.vii.1995.

Chlorops planifrons (Loew, 1866)
In grassy area on The Mound on 13.viii.1997.

Meromyza femorata Macquart, 1835
Malaise trap, 20 – 28.vii.1995. In grassy area on The Mound on 13.viii.1997..

Thaumatomyia glabra (Meigen, 1830)
Malaise trap, present in five collections, May, July, August.

Thaumatomyia hallandica Andersson 1966
Malaise trap, up to 7.vii.1995.

* *Thaumatomyia notata* (Meigen, 1830)
Malaise trap, present in five collections, April- July, September. Silver Garden area, 5.vii.1996. Area C on 13.viii.1997, area A on 31.x.1997 and area D on 26.vi.1998.

OSCINELLINAE

Conioscinella frontella (Fallén, 1820)
Malaise trap, 7 – 20.v.1995, 18 – 27.vi.1996.

* *C. mimula* Collin, 1946
Malaise trap, up to 7.vii.1996.

Elachiptera cornuta (Fallén, 1820)
Malaise trap, 7 – 20.v.1995, 20 – 28.vii.1995. Area A on 13.viii.1997 and area B on 31.x.1997.

Elachiptera austriaca Duda, 1932
Area B on 31.x.1997.

Gaurax fascipes Becker, 1910
Malaise trap, present in six collections, May – July, August.

* *Oscinella frit* (Linnaeus, 1758)
Recorded in the 1961 – 1963 survey as "the form that mines *Anthoxanthum*" Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995.

Oscinella hortensis Collin, 1946
Malaise trap, 10 – 17.viii.1995.

Oscinella maura (Fallén, 1820)
13.viii.1997 near waterfall.

Oscinella nitidissima (Meigen, 1838)
Malaise trap, 10 – 17.viii.1995.

Oscinimorpha arcuata (Duda, 1932)
Malaise trap, 10 – 17.viii.1995, up to 7.vii.1996.

Tricimba cincta (Meigen, 1830)
Malaise trap, 27.vii. – 3.viii.1995, 10 – 17.viii.1995, 31.viii. – 7.ix.1995. Asrea D on 13.viii.1997 and 26.vi.1998.

Tricimba lineella (Fallén, 1820)
Malaise trap, 10 – 17.viii.1995.

HELEOMYZIDAE

Larvae in animal burrows or birds' nests and *Suillia* in particular in fungi. The two *Trixoscelis* species have both been reared from birds' nests. None of the species listed are particularly noteworthy.

HELEOMYZINAE

Oecothea praecox Loew, 1862
Malaise trap, 27.vii. – 3.viii.1995.

HETEROMYZINAE

Heteromyza rotundicornis (Zetterstedt, 1846)
Area B on 31.x.1997 and 1.x.1998.

Tephrochlaemys flavipes (Zetterstedt, [1838])
Malaise trap, 22.ix. – 20.x.1995. Also in area A on 26.vi.1998 and aread D on 1.x.1998.

Tephrochlaemys rufiventris (Meigen, 1830)
Malaise trap, 7 – 22.ix.1995, 21.x. – 28.xi.1996. Area A on 26.vi.1998, areas A and B on 31.x.1997 and 19.x.1998 and in areas B and D on 1.x.1998.

Tephrochlaemys tarsalis (Zetterstedt, 1847)
Malaise trap, 21.x. – 28.xi.1996.

SUILLINAE

Suillia affinis (Meigen, 1830)
Malaise trap, 7 – 22.ix.1995, 25.iv. – 9.v.1996, 15.v. – 19.vi.1997. Areas A and D on 26.vi.1998, area A on 1.x.1998 and area B on 19.x.1998.

Suillia bicolor (Zetterstedt, [1838])
Malaise trap, 21.x. – 28.xi.1996. Areas A and B on 31.x.1997, area A on 1.x.1998 and area B on 19.x.1998.

Suillia notata (Meigen, 1830)
Areas A and B on 31.x.1997.

Suillia pallida (Fallén, 1820)
In area D on 13.viii.1997 and area B on 1.x.1998.

Suillia ustulata (Meigen, 1830)
Malaise trap, 20 – 28.vii.1995.

Suillia variegata (Loew, 1862)
Malaise trap, present in five collections, May, June, August – October. Area C on 13.viii.1997, area D on 26.vi.1998 and area A on 31.x.1997, 1.x.1998 and 19.x.1998.

TRIXOSCELIDINAE

Trixoscelis frontalis (Fallén, 1823)
In areas A, B and D on 26.vi.1998 and area D on 13.viii.1997 and 31.x.1997, frequent on the latter date.

Trixoscelis similis Hackman, 1970
Malaise, 16.v. – 19.vi.1997. A male in area A on 26.vi.1998.

CHYROMYIDAE

This species has been reared from birds nests.

Gymnochiromyia inermis (Collin, 1933)
Malaise trap, 3 – 10.viii.1995.

SPHAEROCERIDAE

A large family represented in Britain by about one hundred and forty species. They are found in a very wide range of habitats, animal burrows, seaweed, wet mud, dung, fungi, etc. The species listed here are all common, apart from *Apteromyia claviventris* and *Pseudocollinella septentrionalis*, which have a more restricted distribution.

COPROMYZINAE
Lotophila atra (Meigen, 1830)
Area D on 26.vi.1998.
Copromyza stercoraria (Meigen, 1830)
Malaise trap, 31.viii. – 7.ix.1995.

LIMOSININAE
Apteromyia claviventris (Strobl, 1909)
Area D on 1.x.1998.
Chaetopodella scutellaris (Haliday, 1836)
Malaise trap, 20 – 28.vii.1995, 10 – 17.viii.1995.
Coproica acutangula (Zetterstedt, 1847)
Malaise trap, 7 – 20.v.1995.
Coproica ferruginata (Stenhammar, 1855)
Area A on 26.vi.1998 and around the compost heap on 31.x.1997.
Coproica vagans (Haliday, 1833)
Around compost heap area on 31.x.1997.
Leptocera fontinalis (Fallén, 1826)
Malaise trap, 7 – 20.v.1995, 25.iv. – 9.v.1996.
Leptocera caenosa (Rondani, 1880)
Area B on 26.vi.1998.
Leptocera nigra Olivier, 1813
Area A on 13.viii.1997 and area D on 31.x.1997.
* *Leptocera limosa* (Fallén, 1820)
Area A on 31.x.1997.
Leptocera lutosa (Stenhammar, 1855)
Area A on 19.x.1998.
(*Leptocera lutosoidea* (Duda, 1938))
* *Limosina silvatica* (Meigen, 1830)
Area A on 31.x.1997.
(*Opacifrons coxata* (Stenhammar, 1855))
Recorded in the 1961 – 1963 survey as *Leptocera coxata*.
(*Pseudocollinella humida* (Haliday 1836))
Recorded in the 1961 – 1963 survey as *Leptocera humida*.
Pseudocollinella septentrionalis (Stenhammar, 1855)
Area A on 1.x.1998.
Pteremis fenestralis (Fallén, 1820)
Area C on 13.viii.1997.
Pullimosina heteroneura (Haliday, 1836)
Malaise trap, 7 – 20.v.1995, 31.viii. – 7.ix.1995.
Pullimosina moesta (Villeneuve, 1918)
Malaise trap, 7 – 20.v.1995.
Spelobia bifrons (Stenhammar, 1855)
One male around compost area 31.x.1997.
Spelobia clunipes (Meigen, 1830)
Malaise trap, up to 7.vii.1995. Area A on 31.x.1997 and abundant around compost heap area, 26.vi.1998.
Spelobia palmata (Richards, 1927)
Malaise trap, 3 – 10.viii.1995.
Spelobia talparum (Richards, 1927)
Malaise trap, 7 – 20.v.1995.

SPHAEROCERINAE

Ischiolepta denticulata (Meigen, 1830)
Malaise trap, 10 – 17.viii.1995.

Ischiolepta pusilla (Fallén, 1820)
Around compost area, 26.vi.1998.

DROSOPHILIDAE

The family is well known for its association with decaying and fermenting fruits, many of these *Drosophila* species could be found around any English garden compost heap. *Drosophila histrio, D. phalerata, D. obscura* and D. *subobscura* have been reared from fungi. *Stegana similis* is a southern woodland species associated with rotten wood and the three species of *Scaptomyza* are common leaf miners.

DROSOPHILINAE

Chymomyza fuscimana (Zetterstedt, [1838])
Malaise trap, 21.x.1996.

Drosophila andalusiaca Strobl, 1906
Areas B and D on 1.x.1998.

Drosophila histrio Meigen, 1830
Area C, 19.x.1998 (reared *ex* decaying fungus, emerged later in October)

Drosophila immigrans Sturtevant, 1921
Area A on 31.x.1997.

Drosophila phalerata Meigen, 1830
A female on ash of old bonfire site, 26.vi.1998.

Drosophila hydei Sturtevant, 1921
Malaise trap, 20 – 28.vii.1995.

Drosophila melanogaster Meigen, 1830
Area A on 1.x.1998.

Drosophila obscura Fallén, 1823
Malaise trap, up to 7.vii.1995, 20 – 28.vii.1995.

Drosophila subobscura Collin, 1936
Malaise trap, present in five collections, May, July – September. Females in area B on 26.vi.1998.

Scaptomyza flava (Fallen, 1830)
Malaise trap, up to 7.vii.1995. Areas B and D on 26.vi.1998 and areas A and B on 31.x.1997.

* *Scaptomyza graminum* (Fallén, 1823)
Recorded in the 1961 – 1963 survey as *Drosophila graminum*. Area A on 26.vi.1998 and near the waterfall on 13.viii.1997.

* *Scaptomyza pallida* (Zetterstedt, 1847)
Recorded in the 1961 – 1963 survey as *Drosophila disticha*. Malaise trap, present in seven collections, May, July – September. Area A on 1.x.1998.

STEGANINAE

Stegana similis Laŝtovka & Máca, 1982
Malaise trap, 7 – 20.v.1995, 31.viii. – 7.ix.1995.

DIASTATIDAE

A woodland species, widespread.

Diastata costata Meigen, 1830
Area B on 1.x.1998.

CAMPICHOETIDAE

Mainly a southern woodland species.

Campichoeta punctum (Meigen, 1830)
Area D on 13.viii.1997 and area A on 1.x.1998.

CAMILLIDAE

These four species are widespread, they are associated with mammal burrows and in some cases the nests of waterfowl.

Camilla atrimana Strobl, 1910
Males and females in area D on 13.viii.1997.

Camilla flavicauda Duda, 1922
Malaise trap, 18 – 27.vi.1996.

Camilla glabra (Fallén, 1823) (= *subfuscipes* Collin, 1937)
A male in area D on 26.vi.1998.

Camilla nigrifrons Collin, 1933
Malaise trap, present in four collections, May, July, August. A female in area B on 26.vi.1998.

EPHYDRIDAE

The larvae of this family are not well known, but most share an aquatic or semi-aquatic habitat. *Hydrellia* are phytophagous. None of these species is noteworthy.

EPHYDRINAE

* *Limnellia quadrata* (Fallén, 1813)
Area A on 13.viii.1997, area D on 31.x.1997 and aread B on 1.x.1998.

* *Parydra coarctata* (Fallén, 1813)
Area B on 26.vi.1998.

(*Scatella stagnalis* (Fallén, 1813))
Scatella tenuicosta Collin, 1930
Area A on 26.vi.1998 and area C on 13.viii.1997.

Scatophila cribrata (Stenhammar, 1844)
Area A on 26.vi.1998.

Discocerina obscurella (Fallén, 1813)
Area B on 26.vi.1998 and 13.viii.1997; area D on 31.x.1997.

Ditrichophora calceata (Meigen, 1830)
Area B on 26.vi.1998 and areas A, B and D on 1.x.1998.

HYDRELLIINAE

* *Hydrellia griseola* (Fallén, 1813)
Malaise trap, 7 – 20.v.1995. Areas A, B and D on 13.viii.1997.

* *Hydrellia maura* Meigen, 1838 (= *modesta* Loew, 1860)
Recorded in the 1961 – 1963 survey as *H. incana*. Area A on 26.vi.1998 and areas A and B on 31.x.1997.

(*Notiphila cinerea* Fallén, 1813)

ILYTHEINAE

Philygria stictica (Meigen, 1830)
Malaise trap, up to 30.vi.1995.

SCATHOPHAGIDAE

Apart from *Norellia* these are all common species. *Norellia spinipes* was only recently added to the British list (Chandler & Stubbs 1969) from Surrey and Bucks. Since then it has become more widespread, and I have taken it several times in my garden in Essex. It has been reared from Daffodils (*Narcissus* spp.) and may well have been imported with Daffodil bulbs,

SCATHOPHAGINAE

Nanna fasciata (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Nanna inermis (Becker, 1894)
Malaise trap, 25.iv. – 9.v.1996.

Norellia spinipes (Meigen, 1826)
Malaise trap, 27.vii. – 3.viii.1995. Area D on 31.x.1997.

Norellisoma spinimanum (Fallén, 1819)
Malaise trap, 25.iv. – 9.v.1996.

* *Scathophaga stercoraria* (Linnaeus, 1758)
Malaise trap, 31.viii. – 7.ix.1995. Area D on 26.vi.1998 and area A on 13.viii.1997.

(*Trichopalpus fraternus* (Meigen, 1826))

ANTHOMYIIDAE

This family has been neglected by British dipterists and relatively little is known of the immature stages, although they do have a wide range of larval habitats. Some are serious agricultural pests.

ANTHOMYIINAE

Adia cinerella (Fallén, 1825)
Malaise trap, 15.viii. – 5.ix.1995.

Anthomyia confusanea Michelsen in Michelsen & Baez, 1985
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.

Anthomyia imbrida Rondani, 1866
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. A male in area B on 26.vi.1998.

Anthomyia liturata (Robineau-Desvoidy, 1830)
Malaise trap, 15.viii. – 5.ix.1995. Area A on 26.vi.1998 and areas A and C on 13.viii.1997.

Anthomyia pluvialis (Linnaeus, 1758)
Malaise trap, 15.viii. – 5.ix.1995.

Anthomyia procellaris Rondani, 1866
Malaise trap, up to 30.vi.1995, 20 – 28.vii.1995, 15.viii. – 5.ix.1995.

Botanophila fugax (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997. Areas A, B and C on 13.viii.1997.

Delia criniventris (Zetterstedt, 1860)
Malaise trap, 15.viii. – 5.ix.1995. A male in area C on 13.viii.1997.

(*Delia florilega* (Zetterstedt, 1845))
Recorded in the 1961 – 1963 survey as *Delia trichodactyla*

Delia platura (Meigen, 1826)
Malaise trap, 15.viii. – 5.ix.1995. Areas A and B on 26.vi.1998.

Eustalomyia festiva (Zetterstedt, 1845)
Malaise trap, 27.vii. – 3.viii.1995.

Eustalomyia hilaris (Fallen, 1823)
Malaise trap, 20 – 28.vii.1995, 17 – 24.viii.1995, 15.viii. – 5.ix.1995.

Eustalomyia histrio (Zetterstedt [1838])
Malaise trap, 15.viii. – 5.ix.1995.

Hydrophoria linogrisea (Meigen 1826)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.

(*Hylemyia variata* (Fallen, 1823))

Paregle audacula (Harris, [1780])
Recorded in the 1961 – 1963 survey as *Egle radicum*. Area A on 13.viii.1997 and on The Mound on 1.x.1998.

Phorbia fumigata (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Subhylemyia longula (Fallén, 1824)
Area B on 13.viii.1997.

Mycophaga testacea (Gimmerthal, 1834)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. Area A on 1.x.1998 and 31.x.1997 and areas A and B on 19.x.1998.

PEGOMYINAE

Pegomya caesia Stein, 1906
Malaise trap, 24.iv. – 15.v.1997.

Pegomya dulcamarae Wood, 1913
19.x.1998, leaf mines in *Solanum dulcamara.*

Pegomya flavifrons (Walker, 1839)
1.x. and 19.x.1998, north end.

Pegomya geniculata (Bouché, 1834)
Malaise trap, 15.viii. – 5.ix.1995.

Pegomya nigrisquama (Stein, 1888)
Area A on 31.x.1997.

Pegomya rufina (Fallén, 1825)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. Area A on 31.x.1997 and at the north end of the garden on 19.x.1997.

Pegomya sociella Stein, 1906
Area D on 31.x.1997.

(*Pegomya solennis* (Meigen, 1826))
Recorded in the 1961 – 1963 survey as *Pegomya nigritarsis*

Pegomya winthemi (Meigen 1826)
Malaise trap, 15.viii. – 5.ix.1995.

FANNIIDAE

Seventeen of the sixty known British species are recorded. Apart from *Fannia gotlandica*, which is listed as notable in Falk (1991), all are widespread, common species.

Fannia aequilineata Ringdahl, 1945
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.

Fannia armata (Meigen, 1826)
Malaise trap, present in twelve collections, April – September.

Fannia atra (Stein, 1895)
Malaise trap, 15.viii. – 5.ix.1995.

Fannia canicularis (Linnaeus, 1761)
Malaise trap, present in six collections, August – November.

Fannia difficilis (Stein, 1895)
Malaise trap, 15.viii. – -5.ix.1995.

Fannia fuscula (Fallén, 1825)
Malaise trap, 20 – 28.vii.1995.

Fannia gotlandica Ringdahl, 1926
Malaise trap, 31.viii. – 7.ix.1995.

Fannia lustrator (Harris, [1780])
Malaise trap, 24.iv. – 15.v.1997.

Fannia pallitibia (Rondani, 1866)
Malaise trap, present in four collections, August – November. Areas A and D on 13.viii.1997 and in area A on 31.x.1997, 1.x.1998 and 19.x.1998.

Fannia parva (Stein, 1895)
Malaise trap, 7-22.ix.1995.

Fannia pauli Pont in Rozkošný, Gregor & Pont, 1997
Malaise trap, 15.v. – 19.vi.1997.

Fannia polychaeta (Stein, 1895)
Malaise trap, present in seven collections, May, July – September. Area D on 26.vi.1998.

Fannia postica (Stein, 1895)
Malaise trap, 7 – 22.ix.1995, 24.iv. – 15.v.1997.

Fannia serena (Fallén, 1825)
Malaise trap, 7 – 22.ix.1995.

Fannia similis (Stein, 1895)
Malaise trap, 7 – 22.ix.1995.

Fannia sociella (Zetterstedt, 1845)
Malaise trap, up to 30.vi.1995, 24.iv. – 15.v.1997.

Piezura graminicola (Zetterstedt, 1846)
Malaise trap, 7 – 20.v.1995, 10 – 17.viii.1995, 15.viii. – 5.ix.1995, 15.v. – 19.vi.1997. Area D on 1.x.1998.

MUSCIDAE

Muscids are strong fliers and often form a large contingent of Malaise trap captures; very few can be identified in the field.

Most of the Coenosiinae species listed are common or very common, though *Pseudocoenosia solitaria* is less frequent. There are no notable records amongst the Muscinae. In the Mydaeinae, *Mydaea ancilla* is the most notable, but it is not a rarity. The most interesting records in this family are in the Phaoniinae; *Helina abdominalis* is a scarce species listed as notable in (Falk 1991), *H. maculipennis* is of localised occurrence whilst *H. obscurata, H. pertusa* and *H. tetrastigma* are somewhat uncommon. Amongst the *Phaonia* species, *P. fusca* is rare, afforded Red Data Book category 3 status in (Falk 1991). Most records are from estuarine sites in south-east England (Assis Fonseca 1968).

COENOSIINAE

Coenosia agromyzina (Fallén, 1825)
Malaise trap, 15.viii. – 5.ix.1995.

Coenosia albicornis Meigen, 1826
Malaise trap, up to 30.vi.1995. Area D on 13.viii.1997.

Coenosia infantula Rondani, 1866
Males in areas A and D on 13.viii.1997.

Coenosia mollicula (Fallén, 1825)
Malaise trap, 7 – 20.v.1995, up to 7.vii.1995, 20 – 28.vii.1995, 15.viii. – 5.ix.1995. Area D on 26.vi.1998.

Coenosia testacea (Robineau-Desvoidy. 1830)
Malaise trap, present in eleven collections, April – September. Area A (on ash of old bonfire site), and area D on 26.vi.1998, area C on 13.viii.1997, area A (males) on 31.x.1997 and 19.x.1998, areas A and B on 1.x.1998.

Coenosia tigrina (Fabricius, 1775)
Malaise trap, present in six collections June – September. Area A on 26.vi.1998 and 19.x.1998, area C on 13.viii.1997 and area B on 1.x.1998.

Limnophora triangula (Fallén, 1825)
Area B on 26.vi.1998.

Pseudocoenosia solitaria (Zetterstedt, [1838])
Malaise trap, 15.viii. – 5.ix.1995.

MUSCINAE

Azelia zetterstedtii Rondani, 1866
Area A on 13.viii.1997.

Hydrotaea irritans (Fallén, 1823)
Malaise trap, 7 – 20.v.1995.

Morellia hortorum (Fallén, 1817)
Area D on 13.viii.1997.

Muscina prolapsa (Harris, [1780])
Malaise trap, April – September.

(*Muscina stabulans* (Fallén, 1817))

Neomyia cornicina (Fabricius, 1781)
Malaise trap, 20 – 28.vii.1995, 25.iv. – 9.v.1996.

(*Polietes lardarius* (Fabricius, 1781))

MYDAEINAE

Hebecnema fumosa (Meigen, 1826)
Area D on 1.x.1998.

Hebecnema nigra (Robineau-Desvoidy, 1830)
Malaise trap, 15.viii. – 5.ix.1995. Area B on 1.x.1998.

Hebecnema vespertina (Fallén, 1823)
Malaise trap, 7 – 22.ix.1995.

Mydaea ancilla (Meigen, 1826)
Malaise trap, 20 – 28.vii.1995.

Mydaea humeralis Robineau-Desvoidy, 1830.
Malaise trap, 7 – 22.ix.1995.

Myospila meditabunda (Fabricius, 1781)
Malaise trap, 20 – 28.vii.1995, 15.viii. – 5.ix.1995, 31.viii. – 7.ix.1995, 7 – 22.ix.1995.

PHAONIINAE

Helina abdominalis (Zetterstedt, 1846)
Malaise trap, 10 – 17.viii.1995, 15.viii. – 5.ix.1995.

Helina depuncta (Fallén, 1825)
Malaise trap, 7 – 20.v.1995, 20 – 28.vii.1995, 7 – 22.ix.1995. Area A on 13.viii.1997 and 31.x.1997.

Helina evecta (Harris, [1780])
Malaise trap, present in eight collections, May – September.

Helina lasiopthalma (Macquart, 1835)
Malaise trap, present in eight collections, April – November. Area A on 26.vi.1998 and area B on 19.x.1998.

Helina impuncta (Fallén, 1825)
Malaise trap, present in six collections, April, May, July – November. Area D on 26.vi.1998 and areas B and D on 1.x.1998.

Helina maculipennis (Zetterstedt, 1845)
Malaise trap, 24.iv. – 15.v.1997.

Helina obscurata (Meigen, 1826)
5.vii.1996, Silver Garden.

Helina pertusa (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Helina reversio (Harris, [1780])
Malaise trap, present in twelve collections, April – September. Silver Garden, 5.vii.1996 and area A on 19.x.1998.

Helina tetrastigma (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia angelicae (Scopoli, 1763)
Malaise trap, 7 – 22.ix.1995.

Phaonia errans (Meigen, 1826)
Malaise trap, 7 – 22.ix.1995, 25.iv. – 9.v.1996. Area A on 1.x.1998.

Phaonia fusca (Meade, 1897)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia fuscata (Fallén, 1825)
Malaise trap, 31.viii. – 7.ix.1995, 7 – 22.ix.1995. Area B on 13.viii.1997 and areas B and D on 26.vi.1998.

Phaonia gobertii (Mik, 1881)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia halterata (Stein, 1893)
Malaise trap, 15.viii. – 5.ix.1995.

Phaonia mediterranea Hennig 1963.
Malaise trap, 21.x. – 28.xi.1996, 15.v. – 19.vi.1997.

Phaonia perdita (Meigen, 1826)
Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995, 25.iv. – 9.v.1996, 7 – 22.ix.1995.

Phaonia rufipalpis (Macquart, 1835)
Area A on 1.x.1998.

Phaonia rufiventris (Scopoli, 1763)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. Area B on 19.x.1998.

Phaonia serva (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia subventa (Harris, [1780])
Malaise trap, 24.iv. – 15.v.1997. Area A on 13.viii.1997.

Phaonia trimaculata (Bouché, 1834)
Area B on 1.x.1998.

Phaonia tuguriorum (Scopoli, 1763)
Malaise trap, present in five collections, July – September. 31.x.1997 A, 26.vi.1998 A.

Phaonia valida (Harris, [1780])
Malaise trap, 3 – 10.viii.1995, 15.viii. – 5.ix.1995, 31.viii. – 7.ix.1995, 7 – 22.ix.1995.

CALLIPHORIDAE

All those recorded are common species, apart from *Bellardia bayeri*, which was only recently added to the British list, (Rotheray 1998), though even that may prove to be widespread now that it is recognised as a British species.

CALLIPHORINAE

Bellardia bayeri (Jacentkowský, 1837)
Malaise trap, up to 30.vi.1995, 27.vii-3.viii.1995, 25.iv. – 9.v.1996. Area A on 1.x.1998 A.

Bellardia vulgaris (Robineau-Desvoidy, 1830)
Malaise trap, 17 – 24.viii.1995, 15.viii. – 5.ix.1995, 31.viii. – 7.ix.1995, 7 – 22.ix.1995.

Calliphora vicina Robineau-Desvoidy, 1830
Malaise trap, present in eight collections, April, May, August – November. Area A on 19.x.1998.

(*Calliphora vomitoria* (Linnaeus, 1758))

LUCILIINAE

Lucilia ampullacea Villeneuve, 1822
Malaise trap, 15.viii – 5.ix.1995.

Lucilia caesar (Linnaeus, 1758)
Malaise trap,, present in five collections, April, May, August – September.

Lucilia illustris (Meigen, 1826)
Malaise trap, 15.viii. – 5.ix.1995, 7 – 22.ix.1995, 24.iv. – 15.v.1997.

* *Lucilia sericata* (Meigen, 1826)
Malaise trap, present in seven collections, April, May July- September. Area D on 26.vi.1998.

MELANOMYINAE

Melanomya nana (Meigen, 1826)
Malaise trap, 20 – 28.vii.1995, 17 – 24.viii.1995.

POLLENIINAE

Pollenia angustigena Wainwright, 1940
Malaise trap, 20 – 28.vii.1995, 7 – 22.ix.1995. Area C on 13.viii.1997.

Pollenia pediculata Macquart, 1834
Malaise trap, 15.viii. – 5.ix.1995, 15.v. – 19.vi.1997.

Pollenia rudis (Fabricius, 1794)
Malaise trap, 3 – 10.viii.1995, 15.viii. – 5.ix.1995, 7 – 22.ix.1995, 21.x. – 28.xi.1996. Silver Garden on 5.vii.1996.

RHINOPHORIDAE

A small family all of whose members are parasitic on woodlice.

Paykullia maculata (Fallén, 1815)
Malaise trap, 20 – 28.vii.1995.

Phyto discrepans Pandellé, 1896
Malaise trap, 17 – 24.viii.1995, 3 – 10.viii.1995, 17 – 24.viii.1995, 7 – 22.ix.1995.

Rhinophora lepida (Meigen, 1824)
Malaise trap, present in eight collections, May, July – September. Areas A and D on 26.vi.1998.

SARCOPHAGIDAE

Sarcophaga africa is the least common in a group of otherwise common species. The *Sarcophaga* species are larviparous, the larvae having a wide range of habitats ranging from dung and carrion or other decaying organic matter to parasitism of other insects and molluscs.

PARAMACRONYCHIINAE

Brachycoma devia (Fallén, 1820)
Malaise trap, present in seven collections April – September.

SARCOPHAGINAE

Sarcophaga africa (Wiedemann, 1824)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.

Sarcophaga carnaria (Linnaeus, 1758)
Malaise trap, present in seven, April – September.

Sarcophaga melanura Meigen, 1826
Malaise trap, 17 – 24.viii.1995, 7 – 22.ix.1995.

Sarcophaga incisilobata Pandellé, 1896
Malaise trap, present in eleven collections, April, May, July – September.

Sarcophaga nigriventris Meigen, 1826
Malaise trap, present in five collections, May, August, September. Area A on 13.viii.1997.

Sarcophaga subvicina Rohdendorf, 1937
Malaise trap, present in nine collections, April, May, July – September.

Sarcophaga vagans Meigen, 1826
Malaise trap, 15.v. – 19.vi.1997.

Sarcophaga variegata (Scopoli, 1763)
Malaise trap, present in six collections, July – September.

TACHINIDAE

Tachinids are principally parasitoids of other insects, the great majority of the species listed here are widespread, common species. *Cinochira* is somewhat local, and *Thecocarcelia* is only the third British record; see Raper (2001) for a review of the status of the species in Britain.

DEXIINAE

Eriothrix rufomaculata (De Geer, 1776)
Malaise trap, present in six collections, July – September. 13.viii.1997 grassland in area E3, herbaceous border.

Ramonda spathulata (Fallén, 1820)
Malaise trap, 25.iv. – 9.v.1996, 24.iv. – 15.v.1997.

Voria ruralis (Fallén, 1810)
Malaise trap, 7 – 22.ix.1995.

EXORISTINAE

Exorista rustica (Fallén, 1810)
Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995.

Thecocarcelia acutangulata (Macquart, 1850)
Malaise trap, 10 –17.viii.1995.

Lydella stabulans (Meigen, 1824)
Malaise trap, 27.vii-3.viii.1995. 1.x.1998. A.

Medina collaris (Fallén, 1820)
Malaise trap, up to 30.vi.1995.

Meigenia mutabilis (Fallén, 1810)
26.vi.1998 A.

Ocytata pallipes (Fallén, 1820)
Malaise trap, present in eight collections, June – November. 26.vi.1998 A B D.

Pales pavida (Meigen, 1824)
Malaise trap, 15.viii. – 5.ix.1995, 3 – 10.viii.1995, 7 – 22.ix.1995, 24.iv. – 15.v.1997.

Phryxe nemea (Meigen, 1824)
Malaise trap, 17 – 24.viii.1995, 7 – 22.ix.1995.

Phryxe vulgaris (Fallén, 1810)
Malaise trap, 7-22.ix.1995.

PHASIINAE

Cinochira atra Zetterstedt, 1845
Malaise trap, 15.viii. – 5.ix.1995, 16.v. – 19.vi.1997.

Phasia pusilla Meigen, 1824
Malaise, 20 – 28.viii.1995. Also in the Silver Garden on 5.vii.1996 and in area D on 26.vi.1998.

* *Lydina aenea* (Meigen, 1824)
Area C on 13.viii.1997.

TACHININAE

Macquartia grisea (Fallén, 1810)
Malaise trap, 25.iv. – 9.v.1996, 21.x. – 28.xi.1996, 24.iv. – 15.v.1997.

Macquartia tenebricosa (Meigen, 1824)
Malaise trap, 21.x. – 28.xi.1996.

Peribaea setinervis (Thompson, 1869)
Malaise trap, 20 – 28.vii.1995.

Phytomyptera cingulata (Robineau-Desvoidy, 1830)
Malaise trap, 15.viii. – 5.ix.1995, 7 – 22.ix.1995, 24.iv. – 15.v.1997.

(*Phytomyptera nigrina* (Meigen, 1824))
Recorded in the 1961 – 1963 survey as *P. nitidiventris.*

Solieria pacifica (Meigen 1824)
Silver Garden, on 5.vii.1996,.

Siphona geniculata (De Geer, 1776)
Malaise trap, present in eleven collections, May – November.

Tachina fera (Linnaeus, 1761)
Malaise trap, 25.iv. – 9.v.1996, 24.iv. – 15.v.1997. Area A on 19.x.1998.

Triarthria setipennis (Fallén, 1810)
Malaise trap, present in seven collections, May – September.

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PLATE K. Buckingham Palace Garden, London. Grassland on top of The Mound. This is area D in the Diptera survey. *Photographed © by Mark Lane*

The scuttle flies (Diptera: Phoridae) of Buckingham Palace Garden

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Abstract

Seventy-five species of scuttle fly are recorded from Buckingham Palace garden. *Megaselia marklanei* **sp. n.** is described from a series of males from the Garden plus a further paratype from France. The diversity of the known natural histories of the recorded species is highlighted and an annotated list presented.

Introduction

Scuttle flies (Diptera: Phoridae) are a large family of small flies that originated not later than the lower Cretaceous. Today they are thought to be the most biologically diverse family of insects in the world. Their larvae are exploiters of every conceivable resource, their habits ranging from dung feeders to obligate parasites. While some are catholic in terms of larval habits most are specialised in varying degrees. Adult feeding includes carrion fluids, plant sugars, fungus spores, cleptoparasites of social insects, preying on small insects, and sucking blood from living insects.

This paper reports on the scuttle flies obtained in a Malaise trap operated on the Mound (just north of the Royal Mews) in Buckingham Palace Garden during 1995. An introduction to the survey of the natural history of this garden has been provided (Plant 1999). The geology, history and habitats are briefly reviewed by McClintock et al. (1999). An earlier survey of the Diptera of the Garden only recorded a single species of Phoridae, *Phora atra* (= *P. aterrrima*) (Richards1964). This species was found to be common in 1995 (see below). The lack of other records by Richards undoubtedly reflects the lack of reliable keys that could be used by a non-specialist in the 1960s. Thus the commonest species in the trap employed in 1995 was *Metopina pileata,* a species only added to the British list when the genus was revised (Disney 1979).

The study of this family has been impeded by formidable taxonomic problems. In particular the modern phorid fauna is dominated by the huge, and taxonomically complex, genus *Megaselia* Rondani. Thus the British phorid fauna exceeds 300 species, with more than 200 belonging to *Megaselia.* The difficulties of species recognition were compounded by the early workers because of their reliance on micro-pinned specimens. A switch to specimens preserved in ethanol for subsequent mounting on slides (Disney 1979) paved the way for new keys to the British species (Disney 1983, 1989). These keys have served two purposes. They have allowed the more confident identification of most specimens as well as serving to indicate when a specimen belongs to a species not previously recorded from Britain. The result is that the British list is continually being augmented (e.g. Disney 1999, Buck and Disney 2001). The present survey continues this trend by describing a further new species below.

A list of the species of a family of insects recorded at a particular site tells us little. Such a list needs to be compared with a regional list and with other sites. Furthermore, by detailing the known natural histories of the recorded species one can open a window on the complex patterns of interrelationships that comprise the ecosystems of the site in question. This is particularly worthwhile with the Phoridae because of the biological diversity of these small flies. I have, therefore, not only provided an annotated list of the species recorded from Buckingham Palace Garden but have also attempted some preliminary comments on the wider significance of this list.

TABLE 1. Scuttle flies which have been reared from decaying organic matter.

Species	**Dung**					**Carrion**				**Refuse in**	
	Insect	Bird	Bat	Rodent	Dog	Snail	Arthropod	Vertebrate		Bumble bee	Wasp nests
								Buried	Exposed		
Conicera similis	-	+	-	-	-	-	-	+	-	-	+
Diplonevra funebris	-	-	-	-	-	+	-	-	-	-	+
Dohrniphora cornuta	-	-	-	-	-	+	+	-	-	-	-
Gymnoptera vitripennis	-	-	-	-	-	-	-	-	-	-	+
Megaselia brevicostalis	-	-	-	-	-	+	+	-	-	-	-
M. densior	-	-	-	-	-	+	-	-	+	-	-
M. giraudii	+	-	-	+	+	+	+	-	+	+	+
M. longicostalis	-	-	-	-	-	+	-	-	-	-	-
M. meconicera	-	-	+	-	-	-	-	-	-	-	-
M. nigra	-	-	-	-	-	+	-	-	-	-	-
M. nigriceps	-	-	-	-	-	-	+	-	-	-	-
M. pleuralis	-	+	-	-	-	-	-	-	-	-	-
M. ruficornis	-	-	-	-	-	+	-	-	-	-	-
M. rufipes	+	+	+	-	-	+	+	-	+	-	+
Metopina oligoneura	-	-	-	-	-	-	-	+	-	-	-
Spiniphora bergenstammi	-	-	-	-	-	+	-	-	-	-	-
Triphleba nudipalpis	-	-	-	-	-	-	-	+	-	-	-
Totals (out of 17)	**2**	**3**	**2**	**1**	**1**	**10**	**5**	**3**	**3**	**1**	**5**

Natural history of the recorded species

The seventy-five species recorded in Buckingham Palace Garden are listed below, with comments on their natural history when anything is known. I first summarise the documented range of natural histories of the species recorded.

The larvae of a number of species are primarily or facultatively saprophagous, exploiting a range of decaying organic matter (Table 1). In addition some of these species, such as *Megaselia rufipes,* will also breed in man-made situations such as compost heaps. Indeed the larvae of the introduced, warm climate, species *Dohrniphora cornuta* will not tolerate frost, but the species has only become established in Britain by breeding in compost heaps, sewage systems and underground rotting organic material in landfill sites, where their larvae are able to escape from ambient temperatures below freezing.

Even this crude collation suggests there is some measure of niche separation in relation to these patchily distributed resources. Only the data for *Megaselia giraudii* and *M. rufipes* indicate broad-spectrum polyphagous saprophage habits. Of these two species, *M. rufipes* is commonly encountered indoors, frequenting waste bins. It is morphologically distinct and shows greater affinity with some warm-climate species than with other British species of *Megaselia.* It is possible that, like the housefly, this species was introduced to Britain by man in Roman times or earlier. By contrast *Dohrniphora cornuta* was first reported from ship cargoes during the twentieth century and no museum specimens have been found that were collected in England before this. The inclusion of *M. nigra* in this table invites comment, as this is primarily a fungus breeder (Table 2). In prolonged dry spells a number of aestivating snails in the soil are apt to die from desiccation and thereby provide a ready resource at a time when fungus sporophores are apt to be scarce. Conversely in prolonged wet spells sporophores tend to be more frequent at a time when snail activity is favoured and moribund snails are scarce.

TABLE 2. Fungus-breeding Phoridae of the Buckingham Palace Garden.

Species	Numbers of host fungi				
	Families	**Genera**	**Species**	**S/F**	**S/G**
Conicera similis	2	2	2	1.0	1.0
Megaselia berndseni	7	10	13	1.9	1.3
M. bovista	2	3	5	2.5	1.7
M. cinereifrons	1	1	1	1.0	1.0
M. flava	4	4	4	1.0	1.0
M. frameata	5	6	6	1.2	1.0
M. giraudii	2	2	2	1.0	1.0
M. hirtiventris	2	3	6	3.0	2.0
M. latior	1	2	2	2.0	1.0
M. nigra	6	7	11	1.8	1.6
M. plurispinulosa	2	2	2	1.0	1.0
M. quadriseta	1	1	1	1.0	1.0
M. rubella	6	7	7	1.2	1.0
M. rufipes	4	4	4	1.0	1.0
M. spinicincta	1	2	2	2.0	1.0
M. sylvatica	1	1	1	1.0	1.0

Sixteen species have larvae that have been recorded in fungus species that have been recorded from the Garden (Henrici 2001). These are summarised in Table 2. This includes two primarily saprophagous species, *Megaselia giraudii* and *M. rufipes*. It is possible that these will only breed in sporophores that have started to decay. Likewise it is not clear as to whether *Conicera similis* is primarily fungivorous or saprophagous. Of the rest it is not clear as to how many are truly fungivorous; as some British species associated with fungi are now known to be parasitoids or predators of the larvae or pupae of Sciaridae (lesser fungus gnats), whose larvae feed on fungus mycelium. *Megaselia nigra*, however, has been intensively studied as it breeds mainly in *Agaricus* species, including the cultivated *A. bisporus* and *A. bitorquis* sold in supermarkets throughout the land. This fly is strictly fungivorous, its larvae feed on the sporophore (the mushroom itself). It and its sibling species *M. hirtiventris* seem to occupy an identical niche, apart from the latter not having been reported from the two cultivated *Agaricus* species — but this negative finding may be due to taxonomic incompetence on the part of economic entomologists. The geographical and ecological co-existence of two sibling species suggests two hypotheses. First the work of Shorrocks (1991) on *Drosophila* has shown that two species are able to exploit the same resource simultaneously providing the resource in question is patchily distributed and the eggs of the two competing species are distributed in an aggregated manner. In these circumstances there may be little evidence of traditional resource partitioning or of competition leading to the local extinction of inferior competitors. I hypothesise, therefore, that *M. hirtiventris* and *M. nigra* will be found to lay their eggs in an aggregated manner. In support of this I note that one nearly always obtains numerous individuals of one of these species when rearing insects from an individual mushroom. This contrasts with some other species that invariably emerge in ones or twos from individual toadstools. The second hypothesis is that the evolution of sibling species occupying the same ecological niche has resulted from classic allopatric speciation and a subsequent overlap of their ranges. The evolution of sibling species occupying different ecological niches could result from sympatric speciation, but ecological divergence is probably a prerequisite for this to occur.

TABLE 3. Predatory and parasitic phorids recorded from Buckingham Palace Garden.

		Phorid habit (f = facultative)		
Species	**Host/Prey**	**Predator**	**Parasitoid**	**Parasite**
Diplonevra nitidula	earthworms	-	-	+
D. pilosella	earthworms	-	-	+
Dohrniphora cornuta	larvae of Psychodidae	+f	-	-
Gymnoptera vitripennis	wasp brood	+f	-	-
Megaselia aequalis	slug eggs	+	-	-
M. angusta	spider eggs	+f	-	-
M. ciliata	slug eggs	+	-	-
M. paludosa	tipulid (cranefly) larvae	-	-	+
Phalacrotophora fasciata	ladybird pupae	-	+	-
Phora holosericea	root aphids	+	-	-
Pseudacteon formicarum	worker ants	-	+	-

Table 3 lists species whose larvae have proven to be predators, parasitoids or parasites, but in some cases they are only facultatively so (e.g. *Dohrniphora cornuta* and *Gymnoptera vitripennis*). These phorids represent at least 14.7 per cent of the list for the Garden; however it requires much more careful and critical investigation to establish the details of their larval biologies. Indeed one encounters much frustration in attempting to rear adults from parasitised hosts due to pupal deaths and other losses. It is postulated that several of the approximately 50 per cent of species in the list whose larval habits are unknown will prove to be specialised predators, parasitoids or even parasites.

With regard to some aspects of the ecology of adult scuttle flies, at least 36 per cent of the species recorded from the Garden have been recorded visiting species of flowering plant that are known to grow in the Garden (McClintock and Wiltshire 1999, McClintock and Lane 1999). Table 4 provides a summary of flower-visiting data.

TABLE 4. Summary of records of phorids visiting flower species that are both recorded from Buckingham Palace Garden.

Plant family	No. plant species	No. phorid genera	No. phorid species
Araceae	1	1	2
Araliaceae	1	2	3
Caryophyllaceae	1	1	1
Asteraceae	7	3	8
Convolvulaceae	2	1	1
Cornaceae	1	1	1
Euphorbiaceae	1	1	1
Magnoliaceae	1	1	1
Oxalidaceae	1	1	1
Parnassiaceae	1	2	4
Ranunculaceae	4	3	5
Rosaceae	4	5	13
Salicaceae	2	3	5
Saxifragaceae	1	1	2
Apiaceae	5	6	16
Totals	**33**	**6**	**27**

It is immediately apparent that flowers with easy access to the nectar are being favoured. Table 5 summarises the data for individual phorid species. For many the number of records are few and far between. Most records are for about a dozen fly species. In the case of *Diplonevra funebris* all the records are for males only. Interestingly the proboscis of its male is markedly more slender than that of the female.

With more than half the recorded species never having been reported visiting flowers, one needs to consider other sources of sugars for fuelling flight. Phoridae originated in the Cretaceous, before the evolution of today's families of flowering plants and before the ready availability of nectar-laden flowers. The evidence indicates that the primitive source of plant-sugars, required by flies as the fuel for flight, is the honeydew of homopteran bugs, which evolved long before the flowering plant radiation in the Tertiary. The hypothesis that the primal sugar-source of phorids is honeydew has been proposed (Disney 1994). Among species recorded from the Garden, I have noted *Megaselia angusta, M. pleuralis, Phora atra* and *Triphleba distinguenda* feeding on honeydew. However much more systematic study of this habit is required. *Diplonevra nitidula* has been observed feeding from a leaf of a runner bean by piercing it at the junction of two small veins. Whether such direct ingestion of plant sap is practiced widely by phorids is not known.

TABLE 5. Flower-visiting Phoridae of Buckingham Palace Garden.

Phorid species	**Flower Families**	**Genera**	**Species**
Conicera dauci	2	3	3
C. similis	1	1	1
Diplonevra funebris	4	8	8
D. nitidula	4	5	5
Megaselia aequalis	1	1	1
M. angusta	8	9	10
M. berndseni	1	1	1
M. brevicostalis	5	10	12
M. ciliata	3	4	4
M. clemonsi	1	1	1
M. giraudii	2	2	2
M. latior	1	1	1
M. longicostalis	2	2	2
M. manicata	1	1	1
M. minor	1	1	1
M. pectoralis	1	1	1
M. pleuralis	2	2	2
M. plurispinulosa	1	1	1
M. propinqua	1	1	1
M. rufipes	2	2	2
M. superciliata	2	2	2
Metopina oligoneura	4	8	8
M. pileata	1	1	1
M. ulrichi	1	1	1
Phora atra	3	4	4
Triphleba distinguenda	2	2	2
T. nudipalpis	2	2	2
Totals	**13**	**28**	**33**

Another feature of flower visiting by phorids is its unpredictability. One can visit a patch of hogweed flowers one day and collect numerous phorids. Two days later none are to be had. I suspect that when honeydew is plentiful on leaf surfaces there is a reduced incentive to visit flowers. When the leaf surfaces have been flushed clean by rain, then the flies may have to resort to flower visiting. Again this hypothesis needs testing by carefully planned field investigations.

While all phorids probably require sugar-rich meals to fuel flight, most females will also require a protein-rich meal to mature their eggs. The sources of these protein-rich meals merit more investigation. Furthermore, this difference in male and female diets is reflected in the prevalence of sexual dimorphism in the proboscis. Some females feed on fungus spores, some on yeasts, and others on carrion fluids. Typically, when they have fresh carrion fluids in the gut the eggs in the ovaries are at most only half developed. The partially consumed corpses of the prey of predatory flies, such as Empididae and Scathophagidae, are common on leaves of herbs where these flies have been hunting. These abandoned corpses then become a source of protein for some phorids. For example, I have observed a *Megaselia pleuralis* female feeding from a cranefly corpse on a leaf of dog's mercury *Mercurialis perennis*. Other phorids feed on blood from living insects.

Discussion

The question can be asked as to how rich is the scuttle fly fauna of Buckingham Palace Garden. Any answer can only be provisional in our current state of knowledge. Achieving a comprehensive inventory survey of the Diptera of a particular site is notoriously difficult (Disney 1986). Collecting in the Garden has been limited both in terms of the time of year and of the collecting method employed. Thus there are phorid species that are characteristic of the winter months (e.g. *Triphleba autumnalis*) and species that are unlikely to be caught in a Malaise trap (see Disney et al. 1982). Secondly, our knowledge of the phorid faunas of other comparable sites is sketchy in the extreme.

Table 6 compares the list for the garden with that for the British Isles, the latter being updated from the most recent checklist of British Diptera (Chandler 1998.)

TABLE 6. Summary of the phorid fauna of Buckingham Palace Garden.

	Number of species		
Genus	**British list**	**BPG list**	**%**
Anevrina	4	1	25.0
Conicera	6	2	33.3
Diplonevra	7	3	42.9
Dohrniphora	1	1	100.0
Gymnoptera	2	1	50.0
Megaselia	227	56	24.7
Metopina	8	4	50.0
Phalacrotophora	2	1	50.0
Phora	13	2	15.4
Pseudacteon	3	1	33.3
Spiniphora	4	1	25.0
Triphleba	23	2	8.7
Total genera	**23**	**12**	**52.2**
Total species	**324**	**75**	**23.1**

The only comparable data are for gardens in Cambridge, mainly my suburban garden plus limited collecting from the University Botanic Garden, as summarised in Table 7. Species recorded in Buckingham Palace Garden but not in Cambridge are indicated by an asterisk (†) in the listing below. In both localities just under a quarter of the species and just over half the genera on the British list have been recorded so far. However, of the combined list (of 104 species) for the two localities only 51 per cent have been recorded in both situations.

TABLE 7. Summary of the phorid fauna of gardens in Cambridge.

	Number of species		
Genus	**British list**	**Cambridge list**	**%**
Anevrina	4	1	25.0
Conicera	6	4	66.7
Diplonevra	7	4	57.1
Gymnophora	4	1	25.0
Gymnoptera	2	1	50.0
Megaselia	227	53	23.3
Metopina	8	5	62.5
Phalacrotophora	2	2	100.0
Phora	13	3	23.1
Pseudacteon	3	1	33.3
Spiniphora	4	2	50.0
Triphleba	23	5	21.7
Total genera	**23**	**12**	**52.2**
Total species	**324**	**82**	**25.3**

The species recorded in Cambridge but not in Buckingham Palace Garden are: *Anevrina urbana, Conicera floricola, C. schnittmanni, Diplonevra glabra, Gymnoptera longicostalis, Megaselia collini, M. dahli, M. diversa, M. flavicans, M. halterata, M. involuta, M. lactipennis, M. longifurca, M. minuta, M. oviaraneae, M. pallidizona, M. simplex, M. spinata, M. subfuscipes, M. subnudipennis, M. tumida, M. verralli, Metopina perpusilla, Phalacrotophora berolinensis, Phora tincta, Spiniphora maculata, Triphleba autumnalis, T. intermedia* and *T. lugubris.*

An annotated list of the scuttle flies (Diptera, Phoridae) recorded in Buckingham Palace Garden

The months of capture in the Malaise trap are given in roman numerals. Except where stated otherwise, the detailed references for the biological information are given in Disney (1994). Included in the list is a species new to science. It is described below and named after the Head Gardener, Mark Lane.

Anevrina thoracica (Meigen)† — viii. Pupae have been reported from the nest of a mole. Females ingest fluids from carrion.

Conicera dauci (Meigen) — v, vii-ix. Adults are known to visit flowers of *Anthriscus sylvestris, Crataegus monogyna* and *Heracleum sphondylium.*

Conicera similis (Haliday) — v, vii-ix. Larvae have been reported from buried carrion and the following species of fungi known from the garden — *Leccinum scabrum* agg. and *Pluteus cervinus.* Adults are known from wasp nests, and also visiting vertebrate carrion and flowers of *Heracleum sphondylium.*

Diplonevra funebris (Meigen) — vii-ix. Larvae are known from dead snails. Adults are known from wasp nests and the males only are known to visit flowers of *Heracleum sphondylium, Hypochoeris radicata, Leontodon autumnalis, Potentilla anserina, Ranunculus acris, Rubus fruticosus* agg., *Sonchus oleraceus* and *Taraxacum* spp.

Diplonevra nitidula (Meigen) — v, vii-ix. Larvae are parasites of the earthworm *Lumbricus terrestris.* Adults are known to visit flowers of *Anthriscus sylvestris, Cornus sanguinea, Heracleum sphondylium, Ranunculus acris* and *Salix cinerea* and have been observed piercing a runner bean leaf and imbibing fluid from it. They also ingest fluids from dead earthworms. In August a number of adults were carrying an adult female of the mite *Macrocheles disneyi* (Fain and Greenwood 1991) attached to the underside of the abdomen. This phoretic mite is specific to this species of scuttle fly and has so far never been collected from any other situation.

Diplonevra pilosella Schmitz — v, vii-ix. Larvae are parasites of earthworms.

Dohrniphora cornuta (Bigot)† — viii. Larvae are known from dead snails, dead insects, decaying plants, decaying organic matter in landfill sites, and trickling filter sewage systems. In the last situation they may become facultative predators on moth fly larvae (Psychodidae) if the competition for the carpet of organic material and microorganisms is too severe. This introduced tropical species will not tolerate frost, hence its preference for situations such as those where decay generates heat. Females ingest fluids from carrion, including dead insects.

Gymnoptera vitripennis (Meigen) — viii-ix. Adults are found in wasp nests and the larvae are scavengers of debris in the nest as well as being facultative predators of the wasp larvae.

Megaselia aculeata (Schmitz) — v, viii.

Megaselia aequalis (Wood) — v, viii. Larvae are predators of slug eggs (*Deroceras* spp.). Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia albicaudata (Wood) — v, ix.

Megaselia altifrons (Wood)† — viii.

Megaselia angusta (Wood) — v, viii-ix. Larvae have been reported from spider egg sacs, but possibly only as a secondary invader of already parasitised egg sacs (Disney 1999). Adults are known to visit flowers of *Arum maculatum, Caltha palustris, Crataegus monogyna, Hedera helix, Heracleum sphondylium, Ranunculus ficaria, Salix caprea, S. cinerea, Stellaria media* and *Taraxacum* spp. Fungus spores and yeasts have been recorded in the crops of females and also a reddish pigment, which is almost certainly the eye pigment of insect prey or carrion. Similar pigment has been reported in the crops, midguts and hindguts of female *Megaselia* species killed soon after preying on fig wasps in South Africa. These flies pierce the head, thorax and abdomen of their prey in order to imbibe the fluidised contents.

Megaselia basispinata (Lundbeck) — v, vii-ix.

Megaselia berndseni (Schmitz) — v, viii. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus campestris, Agrocybe modesta, A. praecox, A. pediades, Boletus edulis, B. piperatus, Calocybe gambosa, Collybia dryophila, Coprinus micaceus, Leccinum scabrum* agg., *Psathyrella candolleana, Russula nigricans* and *Xerocomus chrysenteron.* Adults are known to visit flowers of *Conium maculatum.*

Megaselia bovista (Gimmerthal)† — viii. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus augustus, A. bisporus, A. campestris, Calvatia excipuliformis* and *Langermannia gigantea.*

Megaselia brevicostalis (Wood) — v, vii-ix. Larvae are known from dead snails and dead insects. Adults are known to visit flowers of *Caltha palustris, Crataegus monogyna, Heracleum sphondylium, Hypochoeris radicata, Leontodon autumnalis, Magnolia* sp., *Potentilla anserina, Ranunculus acris, R. bulbosus, R. ficaria, Taraxacum* spp. and *Tussilago farfara,* and fungus spores have been recorded in the crops of females.

Megaselia ciliata (Zetterstedt) — v, vii-ix. Larvae are predators of slug eggs (*Arion* and *Deroceras* spp.). Adults are known to visit flowers of *Crataegus monogyna, Heracleum sphondylium, Pastinaca sativa* and *Salix caprea.*

Megaselia cinereifrons (Strobl)† — viii-ix. Larvae have been reported breeding in the following fungus recorded from the Garden — *Byssomerulius corium.*

Megaselia clemonsi Disney — ix. Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia consetigera (Schmitz) — vii.

Megaselia densior Schmitz — v, vii-ix. Larvae are known from dead snails and small vertebrate carrion (Buck and Disney 2001).

Megaselia devia Schmitz — v, viii, ix.

Megaselia drakei Disney — v, viii.

Megaselia emarginata (Wood)† — v, vii-ix.

Megaselia errata (Wood)† — v.

Megaselia feshiensis Disney† — vii. This species was previously known only from the holotype from Inverness.

Megaselia flava (Fallén) — v. Larvae have been reported breeding in the following fungi recorded from the Garden — *Armillaria mellea, Leccinum scabrum* agg., *Peziza vesiculosa* and *Pluteus cervinus.*

Megaselia frameata Schmitz — v. Larvae have been reported breeding in the following fungi recorded from the Garden — *Bjerkandera fumosa, Coniophora puteana, Meripilus giganteus, Pleurotus cornucopiae, Polyporus squamosus* and *Thelephora terrestris.*

Megaselia giraudii (Egger) — v, vii-ix. Larvae are polyphagous saprophages, exploiting resources such as invertebrate frass, rodent and dog dung, dead snails, dead insects, refuse in bee and wasp nests and decaying plants. They have also been reported breeding in the following fungi recorded from the Garden — *Coprinus micaceus* and *Pleurotus cornucopiae.* Adults have been reported visiting cat dung and also flowers of *Crataegus monogyna* and *Heracleum sphondylium.*

Megaselia gregaria (Wood)† — ix.

Megaselia hendersoni Disney† — ix.

Megaselia hirtiventris (Wood)† — vii, ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus augustus, A. campestris, A. silvaticus, A. silvicola, Macrolepiota rhacodes* and *Psathyrella candolleana.*

Megaselia ignobilis (Schmitz) — ix.

Megaselia infraposita (Wood)† — v.

Megaselia latior Schmitz — ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Coprinus micaceus* and *Psathyrella candolleana.* Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia longicostalis (Wood) — v, vii-ix. Larvae are known from dead snails. Adults are known to visit flowers of *Cirsium arvense* and *Crataegus monogyna.* Fungus spores have been recorded in the crops of females and also fluids from carrion.

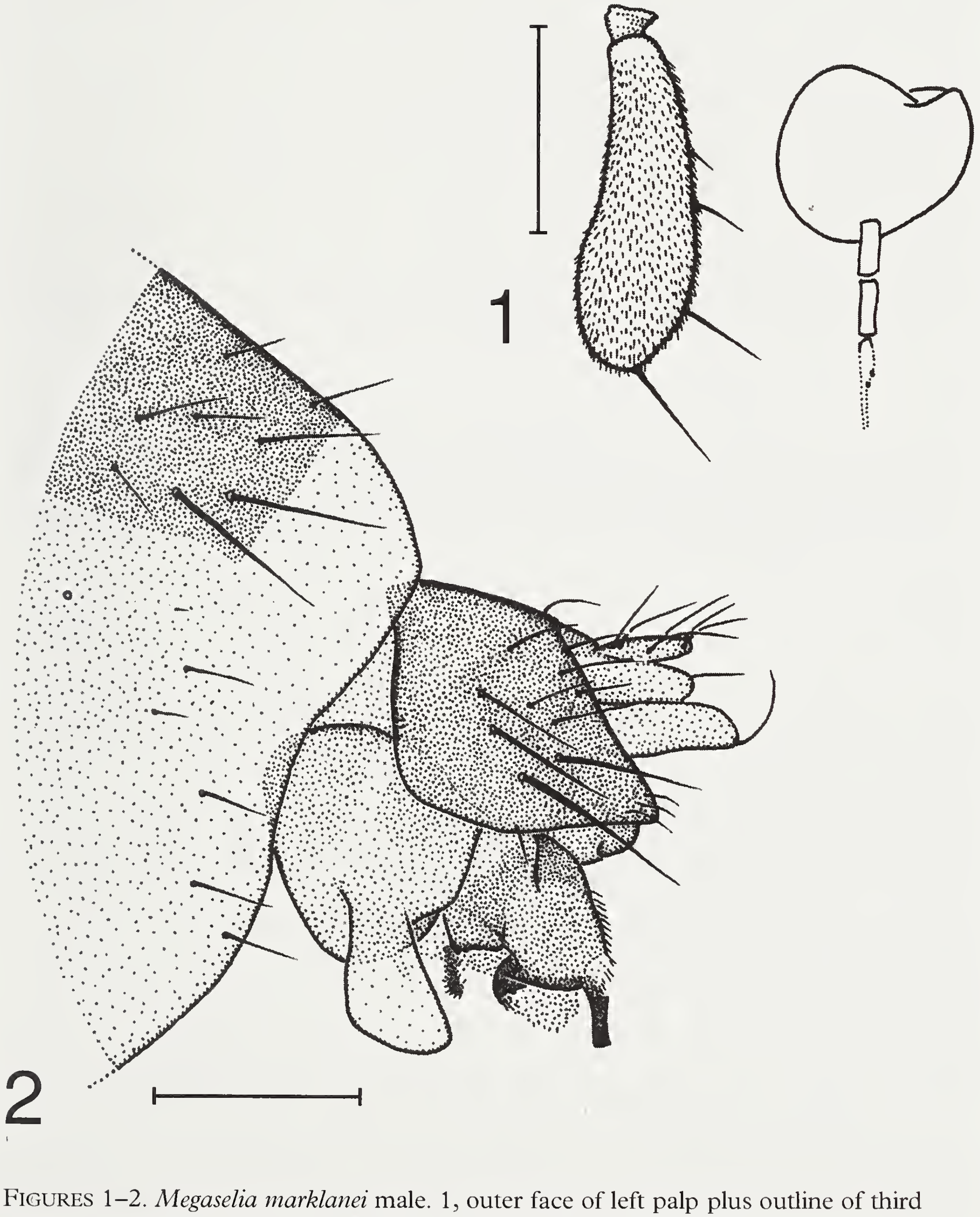
Megaselia manicata (Wood) — viii, ix. Adults are known to visit flowers of *Heracleum sphondylium.*

***M. marklanei* sp. nov.**† — ix.

In the keys to British species (Disney 1989) the males of this species will run to couplets 166 and 176. The elongated, short-bristled, palps are incompatible with the species of couplet 176, including non-British European species that run to this couplet. *M. marklanei* clearly closely resembles *M. longipalpis* (Wood), with which it has been confused in the past, and the Polish species *M. marekdurskii* Disney (in Disney and

Durska 1998), which also runs out at couplet 166. In order to avoid further confusion, I have remounted two cotype males of *M. longipalpis* on slides. These are labelled 'Stoke Wd 2.8.05 — (BM(NH))(E) 239089' and 'Stoke Wd 11.6.06 — (BM(NH))(E) 239090'. The specimen collected in 1905 has been designated the lectotype. A specimen from France that had been attributed to *M. longipalpis* is now recognised as belonging to the new species. The three species are distinguished below.

Megaselia marekdurskii has a pair of minute, hair-like, hypandrial bristles (0.01 mm long) on the inner face. In *M. longipalpis* there are usually no such bristles or else there is a single minute hair (*c.* 0.005 mm long) on the external face of the left side of the hypandrium. In *M. marekdurskii* the hairs at the rear of abdominal tergite 6 are more bristle-like (and feathered) and the legs are more yellowish brown than those of *M. longipalpis*. The new species shares these differences, but has stronger hypandrial bristles (0.05–0.06 mm long), and the left lobe of the hypandrium is not elongated and strongly tapered as in *M. marekdurskii* or twisted as in *M. longipalpis*.



FIGURES 1–2. *Megaselia marklanei* male. 1, outer face of left palp plus outline of third antennal segment. 2, left face of hypopygium. Scale bars = 0.1 mm.

Male only. Frons brown, broader than long (high), with numerous microsetae, and with 76–112 hairs. Lower supra-antennal bristles shorter, weaker and closer together than upper SAs. Antials almost level with or slightly higher than upper SAs, but clearly closer to anterolaterals than to latter. Bristles of middle row in an irregular transverse line, the pre-ocellars being closer together than either is from a mediolateral, but clearly further apart than upper SAs. Third antennal segment brown, but not dark, devoid of SPS vesicles but with an unusually large cavity to accommodate the conus of segment 2. Palps brown, almost as dark as antennae, and as Figure 1, the apical bristle being longer than in *M. longipalpis*. Labrum about as wide as greatest width of palp and pale yellowish brown. Labella with 30-40 short blunt spinules below each. Thorax brown. Each side of scutum with a humeral, three notopleural, an intra-alar, a postalar and a prescutellar dorsocentral bristle. Scutellum with an anterior pair of small hairs (much smaller than those on scutum) and a posterior pair of bristles. Mesopleuron bare. Abdomen with brown tergites with short sparse hairs. Only the posterolateral hairs of T6 are stronger (Figure 2). Venter greyish brown with hairs below segments 3–6. Hypopygium brown, apart from pale greyish yellow left lobe of hypandrium, and as Figure 2. Anal tube brown but distal portion of proctiger more yellowish. Legs yellowish brown, with the femora being darker and that of the hind leg darkest. Fore tarsal segments with ratios of lengths about 2.4 : 1.1 : 1.1 : 0.9 : 1. Only segments 1–4 with a posterodorsal longitudinal hair palisade. The near-dorsal hair palisade of mid tibia extends almost exactly half its length or slightly over. Hairs below basal half of hind femur not differentiated from adjacent hairs of anterior face, and therefore clearly shorter than anteroventral hairs of distal half. Wing length 1.15–1.31 mm. Costal index 0.39-0.42. Costal ratios 3.35–4.20 : 0.94–1.37 : 1. Costal cilia 0.07–0.09 mm long. Veins brown, the costa being more yellowish. Sc free. No hair at base of vein 3. Two axillary bristles, the outermost being at least as long as longest costal cilia. Membrane lightly tinged brownish grey. Haltere brown. Holotype male, ENGLAND: London, Buckingham Palace Garden, 3.viii–7.ix.1995 (Colin. W. Plant) (deposited in Cambridge University Museum of Zoology). Paratypes, 3 males as holotype; 1 male, FRANCE, south end of Cervenne Mountains, near Le Vigan, 25.vii.1984 (Sir Richard Southwood) (CUMZ).

Megaselia meconicera (Speiser) — viii.

Megaselia minor (Zetterstedt)† — v. Adults are known to visit flowers of *Pastinaca sativa.*

Megaselia nigra (Meigen) — ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus augustus, A. bisporus, A. campestris, A. silvicola, A. xanthoderma, Agrocybe praecox, Macrolepiota rhacodes, Melanoleuca melaleuca, Piptoporus betulinus, Psathyrella candolleana* and *Vascellum pratense*. Fungus spores have been recorded in the crops of females.

Megaselia nigriceps (Loew) — viii, ix. Larvae are known from dead insects,

Megaselia paludosa (Wood) — v. Larvae are parasites of cranefly larvae (*Tipula paludosa*).

Megaselia pectoralis (Wood) — v. Adults are known to visit flowers of *Salix caprea.*

Megaselia pleuralis (Wood) — v, vii-ix. Larvae have been reported in bird dung. Adults are known to visit flowers of *Hedera helix* and *Leontodon autumnalis* and to imbibe fluids from dead insects.

Megaselia plurispinulosa (Zetterstedt) — viii. Larvae have been reported breeding in the following fungi recorded from the Garden — *Boletus edulis* and *Pleurotus cornucopiae.* Adults are known to visit flowers of *Anthriscus sylvestris.*

Megaselia propinqua (Wood) — v, viii. Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia pumila (Meigen) — ix.

Megaselia pusilla (Meigen) — v, vii-ix.

Megaselia quadriseta (Schmitz)† — v, ix. Larvae have been reported breeding in the fungus *Russula foetens,* a sibling species of *R. subfoetens* that is frequently not distinguished from it and which has been recorded from the Garden.

Megaselia rubella (Schmitz)† — vii, ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus campestris, Amanita muscaria, Boletus edulis, Leccinum scabrum* agg., *Lepista nuda, Morchella elata* and *Neolentinus (= Lentinus) lepideus.*

Megaselia ruficornis (Megen) — vii, ix. Larvae are known from dead snails and dead insects. Fungus spores have been recorded in the crops of females.

Megaselia rufipes (Meigen) — v, vii-ix. Larvae are polyphagous saprophages, exploiting resources such as invertebrate frass, bird and bat dung, dead snails, dead insects, refuse in bee and wasp nests, dead rats, human corpses and decaying plants. They have also been reported breeding in the following fungi recorded from the Garden — *Agaricus campestris, Bolbitius vitellinus, Boletus edulis* and *Psathyrella candolleana.* Adults are known to visit flowers of *Heracleum sphondylium* and *Oxalis acetosella.* Arthropod scales and hairs have been recorded in the crops of females.

Megaselia spinicincta (Wood)† — ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Coprinus micaceus* and *Pleurotus cornucopiae.*

Megaselia stichata (Lundbeck) — viii, ix.

Megaselia stigmatica (Schmitz) — ix.

Megaselia subcarpalis (Lundbeck)† — viii.

Megaselia subpleuralis (Wood)† — ix.

Megaselia sulphuripes (Meigen)† — v.

Megaselia superciliata (Wood)† — vii. Adults are known to visit flowers of *Arum maculatum* and *Tussilago farfara.*

Megaselia surdifrons (Wood)† — v.

Megaselia sylvatica (Wood) — ix. Larvae have been reported breeding in the following fungus recorded from the Garden — *Pluteus cervinus.*

Megaselia tarsalis (Wood) — viii, ix.

Metopina galeata (Haliday) — v, vii-ix.

Metopina oligoneura (Mik) — ix. Larvae have been reported from buried carrion. Adults are known to visit flowers of *Anthemis cotula, Calystegia sepium, Convolvulus arvensis, Euphorbia helioscopia, Hypochaeris radicata, Leontodon autumnalis, Ranunculus acris* and *Taraxacum* spp.

Metopina pileata Schmitz — v, viii, ix. Adults are known to visit flowers of *Heracleum sphondyleum* and *Taraxacum* spp.

Metopina ulrichi Disney — v, viii, ix. Adults are known to visit flowers of *Heracleum sphondylium.*

Phalacrotophora fasciata (FallÇn) — v, viii. Larvae parasitise pupae of ladybird beetles (Coccinellidae) and adults suck blood from the same.

Phora atra (Meigen) — v, vii-ix. Richards (1964) reported this species in the garden in June and August. Adults are known to visit flowers of *Anthriscus sylvestris, Crataegus monogyna, Prunus laurocerasus* and *Torilis japonica.* Adults have also been reported visiting cat dung.

Phora holosericea Schmitz — v. Larvae prey on root aphids (Aphidiidae and Pemphigidae).

Pseudacteon formicarum (Verrall) — v, viii. Larvae are parasitoids of worker ants, mainly species of *Lasius.*

Spiniphora bergenstammi (Mik) — ix. Larvae are known from dead snails. Adult females feed from vertebrate carrion.

Triphleba distinguenda (Strobl) — v, vii-ix. Adults are known to visit flowers of *Crataegus monogyna* and *Heracleum sphondylium.*

Triphleba nudipalpis (Becker) — vii-ix. Larvae have been reared from dead mice, dead earthworms and other carrion buried in soil. Adults are known to visit flowers of *Hedera helix* and *Salix caprea.*

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Hoverflies (Diptera: Syrphidae) in Buckingham Palace Garden

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Abstract

Hoverflies (Diptera: Syrphidae) were sampled in Buckingham Palace Garden using a single Malaise trap, operated between 20 April 1995 and 18 August 1997 and through regular field survey during the period 1995 to 1997. Thirty-seven species were recorded. Two further species recorded in an earlier survey bring the overall total for the Garden to thirty-nine. The species are listed and discussed. The hoverfly fauna fully reflects the available habitat types.

Introduction and survey methods used

In an earlier survey of Buckingham Palace Garden, carried out in the period from 1961 to 1963 (Richards 1964), a surprisingly low total of seven species of hoverfly was recorded. With the exception of the drone fly *Eristalis tenax*, all the recorded species were members of the aphidiphagous subfamily Syrphinae. It is unclear how many visits were made to the Garden in the earlier survey, as indeed are the dates of such visits, but it seems likely that the level of recording may have been rather lower than the survey co-ordinators at the time may have wished.

At the planning stage of the present survey, it was determined that it would be necessary to sample insects (in all groups) in each month of the year, for each of the three years, in order to obtain as complete a list as possible of the fauna present. Set against this, however, were several inevitable and necessary restrictions placed upon the timing of visits to the Garden by myself and other members of the survey team. In order to maximise results, therefore, a decision was taken to deploy a Malaise trap. This was operated continuously from 20 April 1995 to 18 August 1997 in an area of rough grassland under the shade of a variety of trees (*antea* Plate E, page 108) on The Mound (*antea* Map on pages 2–3).

In addition to sorting hoverflies from the Malaise trap, a number of visits were made to the Garden on various dates throughout the seasons and hoverflies were observed and usually collected, either by netting them in flight or by use of a sweep-net on vegetation. All areas of the Garden were sampled, apart from the large, open areas of mown lawn. Some searching for larvae was also conducted, though this met with only limited success.

Results

An all time total of 39 species of hoverfly is recorded for the Garden. Of these, two species, *Platycheirus clypeatus* agg. and *Sphaerophoria rueppellii*, are now apparently absent from the Garden, so that the current total is 37 species. Eighteen of the 37 were recorded only in the Malaise trap, indicating a certain advantage held by modern entomologists over those who surveyed the Garden in the early 1960s. One species, *Neoascia podagrica*, was found only by active recording and was absent from the Malaise trap samples. Another species, *Platycheirus rosarum*, was represented only in pitfall trap samples. Seventeen species were represented in captures from both active fieldwork and the Malaise trap. All recorded species are discussed individually in the list below.

An annotated list of hoverflies (Diptera: Syrphidae) recorded in Buckingham Palace Garden

Generic and specific nomenclature in this list follow Chandler (1998). The suprageneric taxonomy of the Syrphidae is far from adequately understood. Chandler (*op. cit.*) arranged species strictly alphabetically for this reason. In the present list, however, the arrangement of species follows that of Stubbs and Falk (1983), since this will be the most familiar to British readers and is therefore the sequence most likely to facilitate understanding of the overall fauna. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

SYRPHIDAE
SYRPHINAE
Bacchini

Baccha elongata (Fabricius, 1775)
Recorded in small numbers from April to October, inclusive, though with most examples encountered in June and July. It is associated with ground layer aphids in shaded places (Rotheray 1993) and in Buckingham Palace Garden appears to be confined to the shaded areas under trees growing on The Mound. All records are from the Malaise trap (9♂♂, 19♀♀); searching other potentially suitable areas such as the area around Fire Hole did not yield any additional examples.

Melanostoma mellinum (Linnaeus, 1758)
Apparently scarce, as evidenced by the Malaise trap, which yielded only 19 examples (4♂♂, 15♀♀), between 7.v.1995 and 18.viii.1997, compared with 169 *M. scalare*. Data from the Malaise trap also indicate that adults are on the wing from April to September, but active fieldwork, which also supported the notion that this species is numerically scarce, suggests that there is a definite peak of adult activity in July. The feeding habits of the larvae are uncertain, but it is suspected that they may be general predators in leaf litter (Rotheray 1993). In Buckingham Palace Garden, males and females were recorded in the Malaise trap (rough grassland shaded by deciduous trees), females occasionally in Fire Hole, one female hovering (but not feeding) at ornamental flowers near the Waterfall and one female on the Island at the end of Bridge Number 1 (swept from vegetation).

Melanostoma scalare (Fabricius, 1794)
This is a widespread and numerically common hoverfly in Buckingham Palace Garden. Records from the Malaise trap indicate an adult presence from May to October, but there is a large peak in numbers in the period May to July, with far fewer examples from August to October. Away from the Malaise trap, females were a common sight hovering at a variety of ornamental flowers though, surprisingly, feeding has not been observed. In the Malaise trap, females outnumber males 3:1 (126♀♀, 43♂♂); during active fieldwork far more females were seen than males, but detailed counts were not made.

* *Platycheirus albimanus* (Fabricius, 1781)
This is another widespread and numerically abundant species in the Garden, recorded from March to the end of October both in the Malaise trap (41♂♂, 44♀♀), and through active survey. Other than the lawn areas and The Lake, there can be few areas within the boundary walls that did not produce this ubiquitous species. A female was observed ovipositing on the undersides of leaves of a number of herbaceous plants in the Silver Garden on 5.vii.1996.

(*Platycheirus clypeatus* agg.)
The earlier survey records *Platycheirus clypeatus* during July. In recent years, that taxon has been split into a number of species (Goeldlin de Tiefenau et al. 1990), and since no voucher material has been found it is not possible to say which segregate is in fact referred to. *P. clypeatus* s. str., *P. occultus* and *P. europaeus* are all recorded in the London area. All the segregates seem to be related to a greater or lesser degree to lush vegetation or damp ground and it is presumably the overall dry state of the Garden that is responsible for a complete lack of records of any of these species during the current survey.

Platycheirus scutatus (Meigen, 1822)
This is a common and widespread species of hoverfly in the Garden, on the wing from May to October, but with a clear peak throughout June and, during 1995, a single female in the November Malaise trap sample (28.x.–20.xi.1995). Females outnumber males 2:1 in the Malaise trap (88♀♀, 37♂♂), but this experience is not supported by active fieldwork at the flower borders where more or less equal numbers of each sex were sampled. Since *P. splendidus* Rotheray, a recent 'split' from *P. scutatus*, is not included in Chandler's checklist, it is perhaps worth noting here that this new segregate is not recorded in Buckingham Palace Garden.

Platycheirus rosarum (Fabricius, 1787)

A single female was taken in the pitfall trap in map square E3 (*antea* Map on pages 2-3) during August 1996.

Syrphini

Chrysotoxum bicinctum (Linnaeus, 1758)

Known from the Garden as a single female in the Malaise trap sample for 20–27.vii.1995. This is a somewhat unexpected record in central London, though the species is tolerably common on most ruderal sites alongside the River Thames. The larvae are suspected to be in some way dependant on ants and may perhaps predate ant-tended root aphids (Rotheray 1993), but there appear to be rather few ant nests in the Garden. The possibility exists that this hoverfly was merely passing through the area.

Dasysyrphus albostriatus (Fallén, 1817)

This is typically a woodland edge hoverfly, with arboreal larvae. It is very common on The Mound and in association with the shrubbery areas and trees along the boundary wall at Constitution Hill. The Malaise trap records 7♂♂ and 32 ♀♀ between 7.v.1995 and 18.viii.1997, from April to July, with just two examples (1♂, 1♀) in August 1995. The bulk of records fall into the months of May and June, however.

Dasysyrphus venustus (Meigen, 1822)

This distinctive hoverfly is known in Buckingham Palace Garden as a single female example in the Malaise trap sample for 15.v.–19.vi.1997. Like the preceding species, it is associated with woodland edge and its apparent rarity here is unexpected. Elsewhere in London it is sometimes found hovering beneath blossom-bearing horse-chestnut trees in parks and in street situations, though it is usually seen as single examples.

Epistrophe eligans (Harris, [1780])

Although this is usually a common spring sight in London, rather few examples were found in Buckingham Palace Garden and, interestingly, none at all during 1995. During the subsequent two years it was recorded in the Malaise trap and by active field survey in April and May, but was finished by the start of June. The 35 examples in the Malaise trap included only two males. The larvae feed on aphids on trees, bushes and tall herbs (Rotheray 1993).

* *Episyrphus balteatus* (De Geer, 1776)

This is undoubtedly the most numerically abundant hoverfly in the Garden, with a total of 510 examples in the Malaise trap, comprising 213♂♂ and 297♀♀. However, this species is a known immigrant, and numerical peaks during August in 1996 and 1997 are likely to be partly explained by this behaviour. In particular, there were larger than usual numbers in the middle two weeks of August 1997, coinciding with the only Garden record of *Scaeva pyrastri*, and data from the Malaise traps suggest that both males and females were involved in equal proportions (86♂♂, 82♀♀). Most records fall from April to October, though there was a female in February 1997 and two females in March of the same year.

Eupeodes corollae (Fabricius, 1794)

During 1995, low numbers were present from the start of May until early August, suggesting a low-density resident population. A similar pattern was evident during 1996, though the total number of individuals was far lower (8♀♀) than in 1995 (5♂♂, 22♀♀). In the third survey year, however, there was no sign of this species until the middle two weeks of August, when the appearance of 5♂♂ and 10♀♀ in the Malaise trap coincided with the apparent influx of *Episyrphus balteatus*, mentioned above. It seems likely, perhaps, that temporarily resident populations result from primary immigration and that in the absence of further immigration these do not become permanent.

Eupeodes luniger (Meigen, 1822)

There was an overall total of 248 examples of this species in the Malaise trap, with four times as many females as males (58♂♂, 190♀♀). The fly was also encountered frequently during fieldwork throughout the Garden. Interestingly, there were two peaks in each year, from April until about the end of July and from mid August to September, separated by a gap of about two weeks in early August when there were no records. A sevenfold increase in number in mid June 1997, coinciding with a sudden rise in numbers of *Episyrphus balteatus*, may suggest an influx of immigrants (18♂♂, 56♀♀ in that sample, compared to a more usual level in the order of ten examples). However, there were no *E. luniger* at all in the middle two weeks of August 1997, when there was an influx of *Episyrphus balteatus*, *Eupeodes corollae* and a single *Scaeva pyrastri*.

Meligramma trianguliferum (Zetterstedt, 1843)
Falk (1991) listed this hoverfly as Nationally Notable, though the distribution map in Ball and Morris (2000) suggests that it is either rather more widespread than previously thought or else it has fared rather better in the past ten years. In London, it is increasingly found in domestic gardens and Buckingham Palace Garden is no exception, with five females in the Malaise trap between 7.v. and 27.vii.1995 and one more in the sample for 15.v. to 19.vi.1997. Morris (1998) showed that the species is widely distributed in Surrey, but with a greater density of records nearer to London than elsewhere in that county, and queried whether this reflected the true situation or some form of recording bias. It seems possible that the former may be the case.

* *Meliscaeva auricollis* (Meigen, 1822)
The earlier survey of Buckingham Palace Garden simply records the presence of the species as 'var. *maculicornis* Zett.' in July with no further comment. In the present survey, the Malaise trap caught the species continuously from 7.v. to 27.vii.1995, from 6.vi. to 15.viii.1996 and from 24.iv. to 18.viii.1997 (a total of 17♂♂ and 19♀♀), but it is not possible to discern discrete generations in any of these years. According to Stubbs and Falk (1983) f. *maculicornis*, in which the yellow tergite spots do not coalesce, is typical of the spring generation and far less frequent in that of the summer, where the spots usually unite to form bands. This statement is not fully supported by evidence from Buckingham Palace Garden; although there were slightly more *maculicornis* than *typica* in the early samples, the two forms were both recorded across the year in more or less equal proportion. Morris (1998), writing about Surrey, also notes that there is a 'much darker spring brood'.

Scaeva pyrastri (Linnaeus, 1758)
There is only a single example of this species, a female, in the sample for mid-August 1997. This is presumed to be an immigrant example.

(*Sphaerophoria rueppellii* (Wiedemann, 1830))
This species is frequent, and numerically common, in almost all ruderal habitats alongside the River Thames in London and eastwards around the coast in Essex and Kent, frequently outnumbering *S. scripta* at some sites. It is also found in good number on ruderal plots away from the Thames, at least in north London. It was recorded in the Garden during May in the earlier survey, but has not shown itself to be present during the 1995–1997 study. The only area of ruderal habitat present in the Garden during the current survey was in the vicinity of the Fire Hole, although this area does not bear any real resemblance to the Thames-side ruderal sites and the fly is, very possibly, genuinely absent.

Sphaerophoria scripta (Linnaeus, 1758)
This common grassland hoverfly is evidently very rare in Buckingham Palace Garden, which is rather surprising for a species that is generally widespread and common, exhibits good dispersal and is tentatively linked to immigration on occasions. It was not listed in the earlier survey. In the present study it was found in the Malaise trap, with two males in the sample for 27.iii.–24.iv.1997 and a female, presumed to be this species, in the sample for 24.iv.–15.v. in the same year, whilst Peter Chandler also noted a specimen during August at a herbaceous border. It is rather surprising that sweep-netting and other active collecting techniques did not reveal this species elsewhere in the Garden.

* *Syrphus ribesii* (Linnaeus, 1758)
This more or less ubiquitous hoverfly species can be encountered in most London parks and in other areas where there are trees or shrubs. Buckingham Palace Garden is no exception and adults are common from May to October inclusive, though with a definite peak of numbers in May and June. The earlier survey recorded adults in July, September and October. The Malaise trap caught a total of 88 examples from 1995 to 1997, of which only 27 were male, a ratio of about one male to three females. Adults were also netted on most visits at various points throughout the Garden and larvae were found on aphid-covered leaves of a sycamore tree during July 1995.

Syrphus torvus Osten Sacken, 1875
Although this species is as equally widespread as *S. ribesii* and *S. vitripennis*, it is seldom numerically abundant. Just three females were recorded in Buckingham Palace Garden, all in the Malaise trap — one in the sample for 7–22.ix.1995 and two in that for 27.iii.–4.iv.1997.

Syrphus vitripennis Meigen, 1822
This species is, like its congener *S. ribesii*, a common London species. In Buckingham Palace Garden it clearly has two generations per year, with records in May and June and

then a clear gap before more are encountered in September and October. This is a near fit to the national situation presented by Ball and Morris (2000), who demonstrate peaks in May/June and August/September, although they do not show any gap between the two date bands. Overall the Malaise trap captured 53 examples, comprising 10♂♂ and 43♀♀.

Xanthogramma pedissequum (Harris, [1776])
This species, like *Chrysotoxum bicinctum*, is believed to have some form of myrmecophilous relationship and in view of the scarcity of *C. bicinctum* in the Garden it is perhaps surprising to record 28 *X. pedissequum* over the three years 1995 to 1997, mostly as singletons in the Malaise trap. This perhaps suggests a low-density resident population. Other examples were netted in flight in the Fire Hole area and, interestingly, no males have been encountered at all in the Garden. All records are from May to August, inclusive, but recorded numbers are too low to discern any generation peaks. Outside the Garden, the species is tolerably common, but always in small number, in ruderal sites about London, though the present records appear to be the first for the central area. What we understand as *Xanthogramma pedissequum* probably represents a complex of three species (Kassebeer, in prep.). However, since formal descriptions and names of the segregates have not yet been published it would be inappropriate to comment in too great a depth here. What can be said, to enable these records to be correctly allocated at some future date, is that the specimens from Buckingham Palace Garden belong to the segregate that possesses only a single yellow thoracic mark anterior to the pleurae.

MILESIINAE

Cheilosiini

Cheilosia pagana (Meigen, 1822)
This is an almost ubiquitous hoverfly at London sites. According to Rotheray (1993) larvae of *C. pagana* are associated with semi-liquid fungal decay of plants and have been found in the decaying roots of *Anthriscus sylvestris*. 'Weeds' such as this might well be pulled up by the gardeners, leaving sections of root in the ground to decay and provide a breeding site. Interestingly, the Malaise trap captured ten females between 7.v. and 27.vii.1995, but none at all in the following two years, although occasional adults were found in the Fire Hole area, at ornamental blooms in the Silver Garden and at The Border. As with *Xanthogramma pedissequum*, no males have been encountered in Buckingham Palace Garden.

Chrysogastrini

Neoascia podagrica (Fabricius, 1775)
The fact that the larvae of this species are associated with decaying vegetation, manure and the like, including around pond margins, helps explain why there were no adults at all in the Malaise trap on The Mound, whilst they were seen occasionally in the area around the Recycling Centre (a giant compost heap). Records, which are almost exclusively of females, are available from May to September though the species is not especially numerous here. The disproportionate number of females observed by active field survey suggests strongly that they were likely to be breeding in the areas found and indicates that different methods are required, or else different places need to be searched, to locate the males.

Eristalini

Eristalis (Eoseristalis) intricarius (Linnaeus, 1758)
This bumble-bee mimic is recorded in Buckingham Palace Garden as a single female in the Malaise trap sample for 30.vi.–7.vii.1995.

* *Eristalis (Eristalis) tenax* (Linnaeus, 1758)
The well-known 'drone fly' is, perhaps surprisingly, recorded very sparingly in the current survey. The Malaise trap captured only a single female, in the sample from 15.v.–19.vi.1997, whilst Peter Chandler noted it on two occasions at a herbaceous border during August. It is listed for the earlier survey for October, but no other information is given. The 'rat-tailed maggot' larvae feed in wet, decaying organic material, including liquid manure, eutrophic ponds and similar places.

Myathropa florea (Linnaeus, 1758)
The rather small number of records from the Malaise trap, representing one male and eleven females for the three-year period, suggests that the population of this species is relatively low in the Garden. The records are spread from May to June and August to September. Larvae of *M. florea* are seemingly able to adapt to a wider variety of eutrophic

microhabitats than *Eristalis* or *Helophilus*, and are often found in ground level rot-holes at tree bases, in ditches or even in broken sewers and drains.

Merodontini

Eumerus ornatus Meigen, 1822

A single female of this species was present in the Malaise trap sample taken from 20.v - 23.vii.1995. It is, typically, a fly of broadleaved woodland in south central Britain and its presence in Buckingham Palace Garden was most unexpected. However, like other members of the genus it flies very close to the ground and is easily missed by the entomologist and would have been able to fly underneath the Garden Malaise trap. It is listed as Nationally Notable by Falk (1991), but may have increased in range in recent years.

Eumerus strigatus (Fallén, 1817)

The Malaise trap captured one male and five females during August 1995, but none in subsequent years (perhaps, as with *E. ornatus*, because of their habit of flying so low that they missed the trap). None of this species was found by active field survey.

Eumerus funeralis Meigen, 1822 (=*tuberculatus* Rondani, 1857)

This species is widely known to gardeners as the Lesser Bulb Fly, though the larvae are usually less of a pest than those of *Merodon equestris*, since they tend to occupy bulbs that are already damaged and starting to decompose. In keeping with most sites in the London area, *E. tuberculatus* is evidently more numerous in Buckingham Palace Garden than *E. strigatus* (though both are widespread). Thirty individuals, comprising 12♂♂ and 18♀♀, were taken in the Malaise trap and one female was netted in flight on The Mound during July 1996. Peter Chandler also encountered the species in square E3 (*antea* map on pages 3 and 3) and at the margin of The Lake. Records from the Garden span the period from June to September, but the number of individuals is too low to discern population peaks.

Merodon equestris (Fabricius, 1794)

Known to the horticultural trade as the 'Bulb Fly', this species appears to be thriving in Buckingham Palace Garden, with a total of 46 examples (24♂♂, 22♀♀) in the Malaise trap throughout May, June and July in all three years of the survey, plus others netted at flowers during active fieldwork. This hoverfly is a bumble-bee mimic and is noted for its variety of colour forms, many of which have been named. It is presumed that this variation permits the fly to mimic different bee species, though to what end is unclear. In Buckingham Palace Garden, the colour forms represented in the Malaise trap samples are indicated in Table 1.

TABLE 1. Proportions of named colour forms of *Merodon equestris* recorded in the Malaise trap in Buckingham Palace Garden between 7 May 1995 and 18 August 1997.

Colour morph	**Number**	
	♂♂	♀♀
f. *equestris* Fabricius	20	8
f. *narcissi* Fabricius	4	5
f. *transversalis* Meigen	-	5
f. *validus* Meigen	-	4

There was no seasonality discernible in the four forms, with all distributed randomly across the May to July period. It may be of interest to note that there were no males of f. *transversalis* or of f. *validus*.

Pipizini

Heringia (Neocnemodon) vitripennis (Meigen, 1822)

This species is currently represented by a single female in the Malaise trap sample for 7–20.v.1995. According to Roger Morris (pers. comm.) it is often found by examining Sycamore-tree leaves for resting adults during May. If this is the case, then perhaps a greater amount of field survey in that month would have revealed a stronger presence of this species in the Garden. It may be of interest that I had not encountered this fly until Morris told me how to find it. Since then I have found it on a few occasions in the London area in the manner prescribed. It seems eminently possible, therefore, that it is an under-recorded species in the London area and may well be far more common in Buckingham Palace Garden than the present data suggest.

Volucellini

Volucella inanis (Linnaeus, 1758)

Only a single example of this large and striking hoverfly is recorded in the Garden, a female during August 1997, at a time of raised numbers of *Episyrphus balteatus* and *Eupeodes corollae*, and in the same Malaise trap sample as the only example of *Scaeva pyrastri*. This evidence points to an immigrant example. The species is usually common in the London area; the larvae feed on larvae of social wasps, including *Vespula germanica* and *Vespa crabro*, residing inside the wasps' nest.

Volucella pellucens (Linnaeus, 1758)

As with the previous species, the larvae of *V. pellucens* live inside nests of social wasps, including the hornet, but are scavengers rather than predators. It is a very common insect in the London Area, and is a regular sight at bramble blossom in many areas. The fact that only four examples were noted in Buckingham Palace Garden (two females in the Malaise trap sample for 22.5.–23.vi.1995 and two females in the sample for 27.vi.–11.vii.1996) is rather surprising. Taken with the equally low numbers of the other two members of the genus, and the fact that all three are common London species, the evidence perhaps suggests a shortage of host nests (presumably, most wasp nests in this part of London would be removed before any *Volucella* larvae within could reach maturity).

Volucella zonaria (Poda, 1761)

Prior to about 1940, this was a very rare immigrant to the southern coastline of Britain. Since that period, it has become established at various places along the south coast and especially in the London Area where it is a common resident. Personal experience suggests that there are regular autumn influxes, most often involving only female examples. It is, therefore, rather surprising that it was apparently rare in Buckingham Palace Garden during the survey. A single female only was recorded in the Malaise trap (sample for 7–20.v.1995), and Peter Chandler recorded one at flowers during August. There are no other records. Comments on the shortage of long-term wasp nests given under *V. pellucens*, above, probably apply.

Xylotini

Syritta pipiens (Linnaeus, 1758)

This is a rather frequent hoverfly in the London area and there are few site lists that do not contain it. Interestingly, the Malaise trap caught only a single example — a female in the period 7–20.v.1995. However, field observations indicate that it is a regular and numerous visitor to the various flower beds, especially at the Silver Garden and The Border. Records span the period from May to September, with both males and females captured in more or less equal number.

Xylota segnis (Linnaeus, 1758)

This is another common and widespread species in the London area that is very poorly represented in Buckingham Palace Garden, with only a single example, a male, in the Malaise trap sample for 27.vii.–3.viii.1995 and none seen during active field survey. It is a representative of a generally saproxylic genus, though itself may not be totally dependant upon such microhabitat, having been associated also with silage and decomposing potatoes (Ball and Morris, 2000).

Discussion

That some 61 per cent of the all time total of thirty-eight recorded species are, or are presumed to be, aphidiphagous (all twenty-two Syrphinae plus *Neocnemodon vitripennis*), should not come as a particular surprise in view of the entirely artificial garden habitat under study. Nor indeed should the presence of species whose larvae feed in bulbs (the genera *Eumerus* and *Merodon*). Of greater interest, perhaps, are the species that have not been recorded here.

Wetland species are almost entirely absent, and are represented only by the two species of *Eristalis* (only a single example of each) and by *Helophilus pendulus* (only two examples). These three are rather more generalist than, for example, species within *Anasimyia*, *Chrysogaster* or *Parhelophilus*, and are frequently found as larvae in the detritus that accumulates in garden ponds in the London area. However, whilst lack of suitable habitat offers an easy explanation for the absence of wetland hoverflies, the non-occurrence of the almost ubiquitous *Eristalis arbustorum*, or for that matter *E. pertinax*, is rather more of a mystery.

Lack of appropriate habitat is likely also to be the reason for the absence of members of the large genus *Cheilosia*, which is represented here by a single species — *C. pagana*. According to Rotheray (1993), members of this genus divide into five categories based upon larval feeding styles — mycophagous species, those feeding on the semi-liquid decay of plants, those which tunnel in roots and stems, leaf-mining species and those which feed in the cambium or sap of pine trees. The latter habit is represented in Europe by a single species that does not occur in Britain, whilst the south-east of England is also outside the geographical range of the leaf-mining species. The mycophagous species seem to require good populations of *Boletus* — a microhabitat absent from the Garden. It is presumed that root and stem tunnelling species are unable to survive in the Garden as a consequence of either the absence of natural host plants or the rapid turnover of garden plants that may act as alternative hosts. *Cheilosia pagana*, the only *Cheilosia* present in the Garden, is the only British species that feeds on semi-liquid decay of plants. Many records of this hoverfly are, apparently, associated with stands of *Anthriscus sylvestris* (Alan Stubbs, pers. comm.), although there is no firm evidence as yet to confirm any obligatory relationship.

The near total lack of species associated with dead branches or with decaying stumps is less than surprising in a 'tidy' garden in a city habitat. Species associated with sap runs, such as *Brachyopa insensilis* Collin or *Ferdinandea cuprea* (Scopoli), which are present in the central London area, probably depend to some extent on mechanical damage to trees by humans, so are confined to more public areas, such as Hyde Park. In fact *Xylota segnis* is the only saproxylic hoverfly in the list, and though the larvae do feed on rotting wood, they can also survive in decaying vegetation. It is, in any event, represented here by only a single example.

The genus *Volucella* represents another ecological group. With the exception of *V. inflata* (Fabricius), a saproxylic species which is not expected here, they feed, as larvae, inside the nests of social wasps and/or hornets. All four such species (*V. bombylans, V. pellucens, V. inanis* and *V. zonaria*) are widespread and very common in London (Plant 1986, 1990). In Buckingham Palace Garden, however, *V. bombylans* is not represented, whilst the other three are present on the basis of single specimens for *V. inanis*, two for *V. zonaria* and only four examples of *V. pellucens*. Presumably human intolerance of wasp nests results in a reduction of suitable breeding sites that survive long enough for *Volucella* to complete its life cycle?

The absence of a few species is less easy to explain. For example, there are no records of *Paragus haemorrhous* Meigen, and no representatives at all of the genera *Pipiza* and *Pipizella*. Both *Pipizella viduata* (Linnaeus) and *Pipizella virens* (Fabricius) are both widespread and locally abundant in most ruderal sites within the London Area and are easily netted from white-flowering Umbelliferae (Apiaceae) and other plants. They might be expected to exist in the Garden at one or two spots although it is of note, perhaps, that they are most frequent at sites along the banks of the River Thames. *Paragus haemorrhous* is harder to find, as it generally flies at only one or two centimetres above the ground over bare soil in areas of sparse vegetation (not an abundant habitat in the Garden), and when it rises higher it is usually to visit the flowers of brambles, where use of a net can prove expensive! It is a widespread species on sparsely vegetated ruderal sites throughout London and is far more common than most people seem to realise.

The future

Whilst it is surely likely that one or two further species of hoverfly remain to be discovered in Buckingham Palace Garden, the present list is regarded as more or less complete and certainly representative of the habitats present. On the other hand, the Garden has enormous potential for allowing additional species to become established in the future. In view of the enormous numbers of garden pests devoured by many species of hoverfly, the potential benefits are self-evident. The creation of a saproxylic resource is one easy and obvious conservation step that could be taken towards improving an element of the overall insect fauna that is generally impoverished in this part of London. At present, practically all garden refuse, including any dead wood, is taken to the Recycling Centre where it is shredded and composted; larger timber units are also removed. The retention of both large and small tree branches at the backs of shrubberies or in other places where they are out of sight would have positive benefits in terms of the overall ecology of the Garden. The retention of stumps of trees that are felled would likely encourage further species, though the stumps would not have to be chemically poisoned. 'Rustic' fencing and other barriers, created from trunks and large branches, would also provide a further saproxylic resource that would be of benefit to a wide rage of insects in addition to hoverflies — none of them pests and several of them positively beneficial to gardens.

Wetland is harder to both create and maintain, but a 'bog garden' or similar, particularly if native waterside plants could be established, might also make an aesthetically pleasing attraction. Such a feature could be usefully created at the western end of The Lake, perhaps near The Waterfall, by allowing the bank to slope more gradually into the water and by establishing a shallow, submerged shelf here.

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In order to avoid any ethical conflict arising from me presenting a paper in a peer-reviewed publication of which I am, myself, the editor, I have accepted and incorporated the comments and criticisms of these gentlemen without question.

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Plate L. Buckingham Palace Garden, London. Wild flowers permitted to grow in some grassy areas provide a source of pollen and nectar for hoverflies, solitary bees and many other insects. *Photographed © by Mark Lane*

The bees, wasps and ants (Hymenoptera: Aculeata) of Buckingham Palace Garden

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Abstract

Aculeate Hymenoptera were collected between 1995 and 1998 at Buckingham Palace Garden in Malaise and pitfall trap samples and by minimal active collecting. A total of 89 species was recorded and an annotated list is presented. This is considered to provide a reasonable representation of the aculeate fauna present.

Introduction

Six species of aculeate Hymenoptera were recorded from Buckingham Palace Garden by Richards (1964). The 1995 to 1998 survey records 89 species, of which four were recorded in the earlier work, so that the overall total of aculeates recorded from the Garden is now 91 — about 16% of the British aculeate fauna. This total is, in all probability, representative of the number of species that might be expected in a large ornamental garden at the centre of a large conurbation, but certainly considerably less than would be expected from a less managed or tidy environment, or from wasteland sites of comparable size in London. This is examined further in the discussion.

Collecting methods

Passive sampling

The results are almost exclusively the product of the Malaise trap, and to a much smaller extent, pitfall traps run between 1995 and 1997. The Malaise trap was operated on The Mound [see map on pages 2 & 3 of this *Supplement*, grid square 09], for the entire duration of the survey. Samples from the trap were all passed to Colin Plant, who sorted and extracted the various taxa and passed them to the identifiers. This generated most of the records of aculeate Hymenoptera. Pitfall traps set by Colin Plant were operated at six stations, and again the few aculeates were sorted and passed to me by him.

Active sampling

Unfortunately almost no active sampling has been carried out for aculeate Hymenoptera during the current survey. Colin Plant did some active collecting of aculeates on 5 July 1996, and the resulting specimens were passed to me for identification. From the eleven species collected this resulted in no less than five that were not collected by Malaise or pitfall traps throughout the whole survey. This suggests that other species may remain unrecorded and these could best be found using active fieldwork throughout the season.

Discussion

Habitats and ecological requirements

Adult aculeate Hymenoptera require suitable nectar sources and many bee species require specific plant species to provide pollen to stock their cells. Flowerbeds and flowering shrubs provide valuable forage for various bees if they contain suitable plant species. The planting of hawthorn (*Crataegus* spp.) in the garden is very favourable to a number of spring and early summer bee species, which will use the blossom as a nectar and pollen source. Predatory wasps require suitable hunting areas that provide the specific prey-species and a number of wasp species successfully use ‘woodland edge’ habitat in gardens. Aculeates also require suitable nesting areas. For many, this involves the availability of bare ground, usually sandy, sometimes firm, sometimes loose and in various aspects ranging from flat ground to vertical banks. The mining bee *Andrena fulva* is particularly frequent in gardens. It prefers light soils in warm and sunny situations, including well-trodden paths, on lawns and other short cropped or sparsely vegetated areas (Falk 1991). Other mining bees common in garden situations include the *Andrena bicolor, A. fulva, A. nigroaenea* and their cleptoparasites *Nomada fabriciana, N. fulva, N. marshamella* and *N. goodeniana*. Then there are species of bees and wasps which nest in the dead stems of scrub and herbaceous plant species and in standing dead trees and old fence posts in sunny situations. In residential situations, some species of cavity nester may be frequent. Old walls, eaves and dead timber in gardens often provide suitable cavities for common species such as the mason bee *Osmia rufa*, the leaf cutter bees *Megachile centuncularis* and *M. willughbiella*, the small halictine bee *Lasioglossum smeathmanellum* and the yellow-faced bee *Hylaeus communis*. The cleptoparasitic ruby-tailed wasps *Chrysis angustula* and *C. ignita* agg. are also fairly frequent in one or more of these situations where their hosts are established.

It is difficult to definitively categorise the nest sites used by all the species recorded in Buckingham Palace Garden, since some species will use a range of available cavities, including burrows in the soil, stems, and pre-formed burrows in mortar, dead wood and masonry. However, approximately 36% are typically ground nesters, 51% aerial or cavity nesters and 13% are parasitic or cleptoparasitic on other species. Whilst many gardening activities will never allow the long-term establishment of suitable nesting habitat for most aculeates, the numbers of species collected in the Malaise trap samples suggests there must be beneficial nesting, foraging and hunting areas present somewhere within Buckingham Palace Garden. Nest sites have to be relatively undisturbed through the season and from one year to the next to ensure the survival of larvae and pupae and the continuity from one generation to the next. Although intermittent surface disturbance is frequently important in the maintenance of the bare ground favoured by many ground-nesting species, the annual digging of ground for the planting of herbaceous flower beds and vegetable plots will not allow the survival of ground nests. Aculeate species are, therefore, only likely to nest successfully in relatively undisturbed banks and corners of gardens, but these undisturbed areas are not unusual and in a garden of this size various areas may remain undisturbed for twelve months or more; this continuity of habitat is extremely beneficial to the populations of aculeates. The regular pruning and tidying up of dead flowers and the removal of seed-heads and dead stems will prevent the establishment of stem nesting species, but careful pruning of shrubs and hollow stem plants can provide important nesting sites if these stems are allowed to over-winter until the next season. Re-pointing and cleaning of old walls and the replacement of old fences, also removes nesting habitat for cavity nesting species favouring cavities. Dead tree trunks are often removed in gardens, but if these are left *in situ* to age, they are usually extremely beneficial to a whole range of invertebrates.

The recorded fauna

It is quite unusual to have regular survey data over a duration of three years. Analysis can be used to assess the likely completeness of the recorded aculeate Hymenoptera list. An accumulation graph of the numbers of species recorded over the survey period (Figure 1) suggests that the total is still rising and more species remain to be found. On the other hand this may be due to the capture of casual wanderers from outside the Garden, but this is an effect that is difficult to assess.

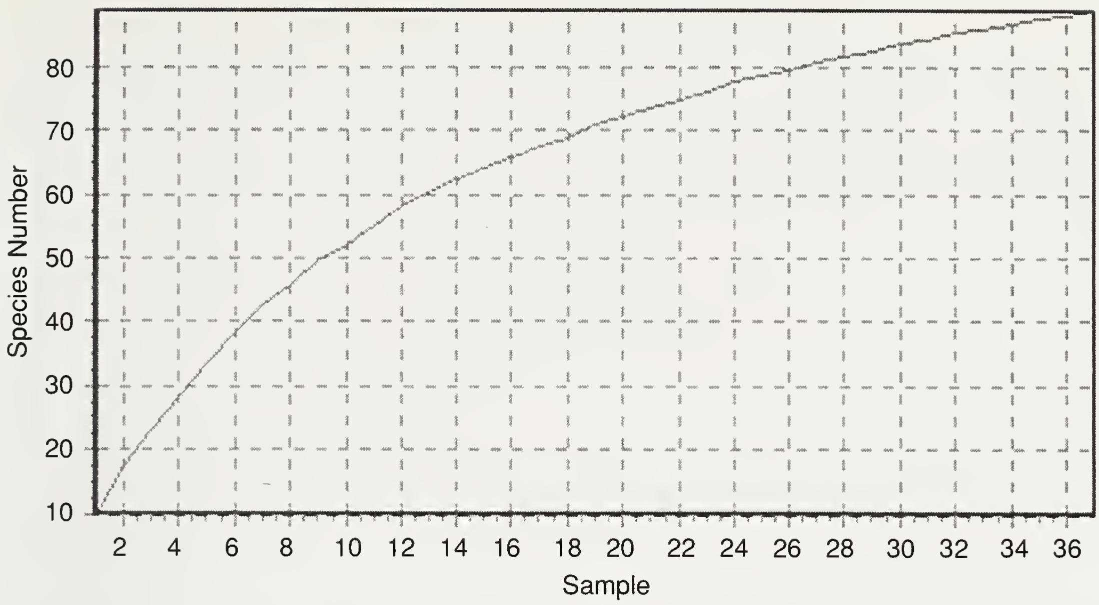

FIGURE 1. Graph of the numbers of species recorded over the survey.

The smaller number of regularly recorded species also implies the total is overestimated. Of the 89 species recorded during the current survey, only twenty-six species were recorded in every year of the survey (Table 1). On the other hand the number of new species recorded on the one occasion when active field sampling was undertaken suggests further species remain unrecorded. Twenty-six species were recorded only once throughout the whole survey period. This may indicate that these species are either present at a low population levels, are very localised within the gardens, or are not resident in the gardens, but casual visitors from other areas such as St James Park, Hyde Park or Kensington Gardens. On the other hand it may reflect the limited survey methods used to record the aculeate hymenoptera during this project. Eighteen species were recorded as a single individual only once throughout the whole survey period, and might be interpreted as casual to the gardens. If these are removed from the sample, the accumulation graph now looks like Figure 2. This suggests the species total might be levelling off at something over seventy species. Data on the number of occasions species were recorded during the survey is summarised in Table 1.

Number of occasions each species was recorded	**1995**	**1996**	**1997**	**Over whole survey period 1995–97**
Species recorded on 1 occasion	19	27	28	26
Species recorded on 2 occasions	18	16	11	12
Species recorded on 3 occasions	5	6	4	12
Species recorded on 4 occasions	4	5	4	10
Species recorded on 5 or more occasions	43	35	42	29
Total number of species recorded during the current survey				**89**
Number of species recorded every year of the survey				26
Number of species recorded as a single individual, only once during the whole survey period				18

TABLE 1. Numbers of species recorded during the survey period. An occasion is defined here to be from one Malaise or pitfall trap sample period or a single date.

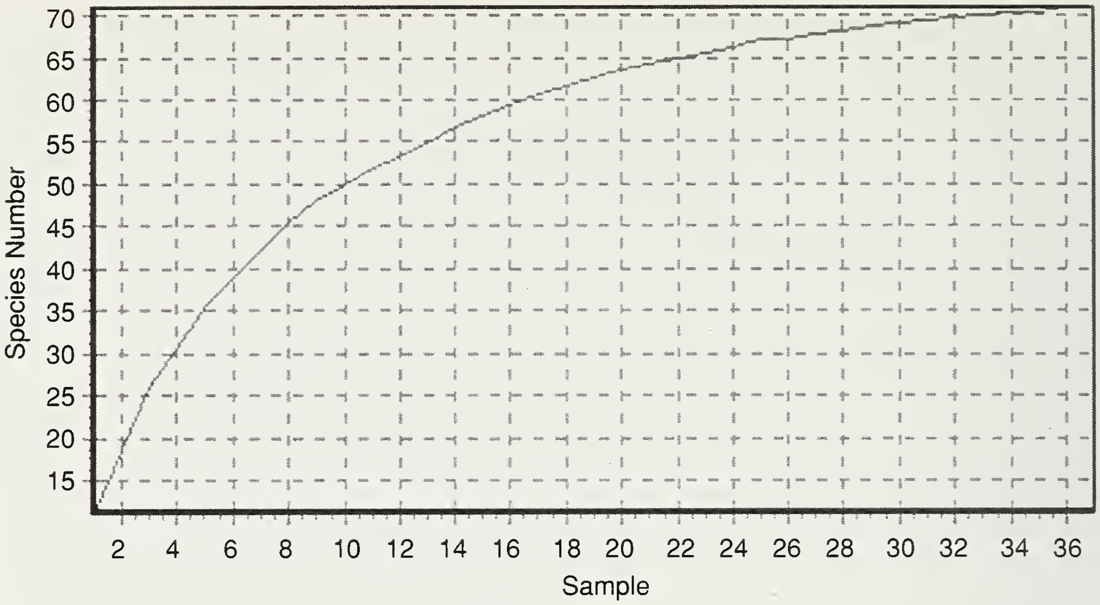

FIGURE 2. Graph of the numbers of aculeate species recorded over the survey, with species recorded as a single individual only once during the three year survey removed from the sample.

Few sites in the London area have been surveyed for aculeate Hymenoptera, and very little data published. Yeo (1957) and Felton (1967) published results of collecting at Bushy Park and Hampton Hill, Middlesex. In total, 121 species were recorded. Guichard (1938, 1939) published results of a survey at Limpsfield Common, and recorded ninety species; the author expected that the species total should be at least 150 when the area had been worked properly. Yarrow (1940) and Guichard & Yarrow (1947) published results for Hampstead Heath, with a list of 216 species of which more than 150 were recorded during the century of publication. Morris (1997) records 182 species of aculeate Hymenoptera for Mitcham Common, based on most extensive recording in the period 1990-1992, but extending back to the late 1970s. All these sites are likely to be far richer than large gardens, where the diversity and range of relatively unmanaged habitats is simply not represented. Against this background, the fauna recorded during the current survey of Buckingham Palace Garden appears to be quite representative of what could be expected of a large garden in central London, although it does include, perhaps unexpected, Nationally Scarce species such as the spider-hunting wasp *Auplopus carbonarius*, the sphecid wasps *Mimesa (Psen) bruxellensis*, *Nysson trimaculatus*, and *Lestiphorus (Gorytes) bicinctus* and the mining bee *Andrena tibialis*.

An annotated list of Hymenoptera: Aculeata recorded in Buckingham Palace Garden

Species found in the earlier survey, but not found during the present study, are shown in parentheses whilst those recorded in both surveys are indicated by an asterisk. 'Red Data Book' and 'Notable' species are those listed by Falk (1991). Nomenclature broadly follows that used in Edwards (1997, 1998, 2001) and a forthcoming checklist being compiled by the Natural History Museum; authorities are given for species names so that any confusion might be avoided. Comments on the London area status of the aculeate Hymenoptera are based on the very limited published information available and the author's experience of species distribution in the Essex, north Kent and the East Thames Corridor (Harvey 2000a).

HYMENOPTERA

ACULEATA

CHRYSIDOIDEA

BETHYLIDAE

Laelius microneurus (Kieffer, 1906)
A single specimen in the Malaise trap sample for 15 August – 5 September 1997.

CHRYSIDIDAE

Omalus auratus (Linnaeus, 1758)
A single specimen in the Malaise trap sample for 11 July – 1 August 1996.

Chrysis angustula Schenck, 1856
Fifteen specimens in Malaise trap samples during 1995, 1996 and 1997.

Cleptes semiauratus (Linnaeus, 1761)
Eight specimens in Malaise trap samples in 1995 and 1996. Notable (Nb). Almost certainly scarce in the London area.

SCOLIOIDEA

TIPHIIDAE

Myrmosa atra Panzer, 1801
A single male in the Malaise trap sample for 27 July – 3 August 1995.

FORMICOIDEA

FORMICIDAE

(*Myrmica rubra* (Linnaeus, 1758) *(as M. laevinodis* Nylander))

Myrmica sabuleti Meinert, 1861
Sixteen workers in a pitfall trap in 1997.

Myrmica scabrinodis Nylander, 1846
One alate female in a pitfall trap between 5 September and 21 October 1996.

Lasius niger sensu lato
Ten workers and one alate female in Malaise trap samples and one pitfall sample in 1995, 1996 and 1997.

(*Lasius umbratus* (Nylander, 1846))

POMPILOIDEA

POMPILIDAE

Dipogon variegates (Linnaeus, 1758)
Two females were taken in the Malaise trap sample for 18 July – 13 August 1997.

Auplopus carbonarius (Scopoli, 1763)
Two females taken in Malaise trap samples for 18 –27 June 1996 and 11 July – 1 August 1996. Notable(Nb). Rare in London, but possibly under-recorded.

Agenioideus cinctellus (Spinola, 1808)
One female taken in Malaise trap between 15 August and 5 September 1996.

Arachnospila anceps (Wesmael, 1851)
Four males and one female taken in Malaise trap samples for 27 July – 3 August 1995, 24 – 31 August 1995 and 6 – 18 June 1996.

VESPOIDEA

VESPIDAE

EUMENINAE

Ancistrocerus gazella (Panzer, 1798)
One male and three females taken in Malaise trap samples for 7 May – 30 June 1995 and 15 May – 19 June 1997. Two females collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Ancistrocerus trifasciatus (Müller, 1776)
Eight females taken in the Malaise trap sample for 15 May – 19 June 1997.

Symmorphus mutinensis (Baldini, 1894)
Three females taken in Malaise trap samples for 20 May – 23 June 1995, 30 June – 7 July 1995 and 11 July – 1 August 1996.

VESPINAE

Dolichovespula media (Retzius, 1783)
Seven workers taken in Malaise trap samples for 7 – 20 May 1995, 27 July – 3 August 1995, 15 August – 21 October 1996. Notable (Na). First recorded in Britain in 1980, this wasp is now relatively widespread and common in England, northwards to Cumbria and Durham (Archer *et al.*, in Edwards, 1995).

Dolichovespula norwegica (Fabricius, 1781)
A single worker in the Malaise trap sample for 18 July – 13 August 1997.

Dolichovespula sylvestris (Scopoli, 1763)
A single male in the Malaise trap sample for 20 – 28 July 1995 and a single queen in the Malaise trap sample for 25 April – 9 May 1996.

Dolichovespula saxonica (Fabricius, 1793)
Two males in the Malaise trap sample for 3-10 August 1995. RDBK. First recorded in Britain in 1987, this wasp has extended its range as far north as Norfolk (Archer *et al.*, in Edwards, 1995).

Vespula germanica (Fabricius, 1793)
Common in Malaise trap samples between April and November throughout the survey, but less so than *V. vulgaris*.

Vespula vulgaris (Linnaeus, 1758)
Common in Malaise trap samples between April and November throughout the survey.

SPHECOIDEA

SPHECIDAE

Trypoxylon attenuatum Smith, F., 1851
Five females taken in Malaise trap samples during 1995 and 1996.

Trypoxylon clavicerum Lepeletier & Serville, 1828
One male and three females taken in Malaise trap samples during 1995 and 1996.

Trypoxylon medium de Beaumont, 1945
One female taken in the Malaise trap sample for 23 – 30 June 1995.

Crossocerus annulipes (Lepeletier & Brullé, 1834)
One male and twenty females taken in Malaise trap samples during 1995 and 1996.

Crossocerus distinguendus (Morawitz, A., 1866)
Two males and eighteen females taken in Malaise trap samples during 1995, 1996 and 1997. Notable (Na). Now fairly widespread in much of south-east England.

Crossocerus elongatulus Vander Linden, 1829)
Four females taken in Malaise trap samples during 1995, 1996 and 1997, and one male collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Crossocerus ovalis Lepeletier & Brullé, 1834
One male and two females taken in Malaise trap samples during 1995.

Crossocerus podagricus (Vander Linden, 1829)
One male and two females taken in Malaise trap samples during 1996.

Crossocerus pusillus Lepeletier & Brullé, 1834
Three females taken in Malaise trap samples during 1995.

Crossocerus quadrimaculatus (Fabricius, 1793)
Four males and twelve females taken in Malaise trap samples during 1995, 1996 and 1997.

Crossocerus tarsatus (Shuckard, 1837)
Two females, one taken in the Malaise trap sample for 1 – 15 August 1996 and one 15 August – 5 September 1996.

Ectemnius cavifrons (Thomson, 1870)
Two males and nine females taken in Malaise trap samples during 1995, 1996 and 1997.

Ectemnius cephalotes (Olivier, 1792)
Four males and thirty-seven females taken in Malaise trap samples during 1995 and 1996.

Ectemnius lituratus (Panzer, 1804)
Two males and two females taken in Malaise trap samples during 1995, 1996 and 1997.

Rhopalum clavipes (Linnaeus, 1758)
Three males and two females taken in Malaise trap samples during 1995, 1996 and 1997.

Rhopalum coarctatum (Scopili, 1763)
One male and two females taken in Malaise trap samples during 1996 and 1997.

Mimesa bruxellensis Bondroit, 1934
One female taken in the Malaise trap sample for 1 – 15 August 1996. Notable (Na). Scarce in the London area, but collected in Thamesmead in 1997 by the author and C.W. Plant and recorded from Bushy Park (Yeo, 1956). The species might occur in other Royal Parks.

Mimesa lutaria (Fabricius, 1787)
One female taken in the Malaise trap sample for 18 July – 13 August 1997.

Psenulus pallipes (Panzer, 1798)
Three males and five females taken in Malaise trap samples during 1995 and 1996.

Stigmus pendulus Panzer, 1804
Seventy-four adults of both sexes taken in malaise trap samples during 1995, 1996 and 1997. RDBK. First recorded in Britain in 1986, this wasp is now known to be widespread in south-eastern England.

Pemphredon inornatus Say, 1824
One female taken in the Malaise trap sample for 20 May – 23 June 1995.

Pemphredon lugubris (Fabricius, 1793)
One male and twelve females taken in Malaise trap samples during 1995, 1996 and 1997.

Passaloecus corniger Shuckard, 1837
Five females taken in Malaise trap samples during 1995, 1996 and 1997.

Passaloecus gracilis (Curtis, 1834)
Two males and twenty-six females taken in Malaise trap samples during 1995, 1996 and 1997.

Passaloecus singularis Dahlbom, 1844
Three females taken in Malaise trap samples during 1995.

Mellinus arvensis (Linnaeus, 1758)
One female taken in the Malaise trap sample for 10 – 17 August 1995.

Nysson trimaculatus (Rossius, 1790)
Twelve females taken in Malaise trap samples during 1995, 1996 and 1997. Notable (Nb). Reasonably widespread in sandy and post-industrial sites with some scrub in the east Thames region and in south-west London and Surrey heathlands. It has been recorded from a roadside hedge in central London (Edwards & Telfer 2001).

Lestiphorus (Gorytes) bicinctus (Rossius, 1794)
One female taken in the Malaise trap sample for 10-17 August 1995. Notable (Nb). Reasonably widespread but scarce in sandy and post-industrial sites in the east Thames region, as well as southwest London and Surrey (see map in Edwards & Telfer 2001).

APOIDEA

APIDAE

COLLETINAE

Colletes daviesanus Smith, F., 1846
Two males and two females collected by C.W. Plant on 5 July 1996 in the Silver garden area.

Hylaeus brevicornis Nylander, 1852
One male taken in the Malaise trap sample for 11 July – 1 August 1996.

Hylaeus communis Nylander, 1852
Seven males and four females taken in Malaise trap samples during 1995, 1996 and 1997.

Hylaeus hyalinatus Smith, F., 1842
One male collected by C.W. Plant on 5 July 1996.

ANDRENINAE

Andrena bicolor Fabricius, 1775
One male and four females taken in Malaise trap samples during 1995 and 1996, and one male collected by C.W. Plant on 5 July 1996 in the Silver Garden area.

Andrena fulva (Müller in Allioni, 1766)
One male taken in the Malaise trap sample for 27 March – 24 April 1997 and one female in the Malaise trap sample for 24 April – 15 May 1997.

Andrena haemorrhoa (Fabricius, 1781)
Four males and thirteen females taken in Malaise trap samples during 1995, 1996 and 1997.

Andrena minutula (Kirby, 1802)
One male and two females collected by C.W. Plant on 5 July 1996 in the Silver Garden area.

Andrena nigroaenea (Kirby, 1802)
Three males and seven females taken in Malaise trap samples during 1996 and 1997.

Andrena nitida (Müller, 1776) [*Andrena pubescens* Olivier, 1789]
Two females taken in Malaise trap samples during 1997.

Andrena semilaevis Pérez, 1903 [= *Andrena saundersella* Perkins, R.C.L., 1914]
Six males and seven females taken in Malaise trap samples during 1995, 1996 and 1997.

Andrena scotica Perkins, R.C.L., 1916
Four females taken in Malaise trap samples during 1996 and 1997.

Andrena synadelpha Perkins, R.C.L., 1914
One male taken in the Malaise trap sample for 15 May – 19 June 1997.

Andrena tibialis (Kirby, 1802)
One male was taken in a Malaise trap sample dated 16 April 1997. Notable (Na). The species is scarce, but possibly widespread, in the east Thames and London areas.

HALICTINAE

Lasioglossum calceatum (Scopoli, 1763)
One male taken in the Malaise trap sample for 1 – 15 August 1996.

Lasioglossum leucopus (Kirby, 1802)
Two females taken in the Malaise trap sample for 18 July – 13 August 1997.

Lasioglossum malachurum (Kirby, 1802)
Three males taken in Malaise trap samples for 10 – 17 August 1995 and 17 – 24 August 1995. Notable (Nb). This species is widespread and frequent in much of the East Thames Corridor and Essex (Harvey 2000b) and is widespread in Surrey (Baldock & Collins 2000). It is probably widespread in other parts of the London area.

Lasioglossum morio (Fabricius, 1793)
Nine males and twenty-two females taken in Malaise trap samples during 1995, 1996 and 1997.

Lasioglossum parvulum (Schenck, 1853)
One male taken in the Malaise trap sample for 20 May – 23 June 1995 and one male taken in the Malaise trap sample for 20 – 28 July 1995.

Lasioglossum smeathmanellum (Kirby, 1802)
Four females taken in Malaise trap samples during 1995 and 1997.

Lasioglossum villosulum (Kirby, 1802)
Two males and two females taken in Malaise trap samples during 1995, 1996 and 1997.

Sphecodes geoffrellus (Kirby, 1802) [= *Sphecodes fasciatus* von Hagens, 1882]
One female taken in the Malaise trap sample for 3 – 10 August 1995.

Sphecodes puncticeps Thomson, 1870
One male taken in the Malaise trap sample for 17 – 24 August 1995.

MEGACHILINAE

Anthidium manicatum (Linnaeus, 1758)
Two males and two females collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Osmia rufa (Linnaeus, 1758)
Nine males and eighteen females taken in Malaise trap samples during 1996 and 1997.

Megachile centuncularis (Linnaeus, 1758)
One male taken in the Malaise trap sample for 6 – 18 June 1996, one female taken in the Malaise trap sample for 7 – 20 May 1995 and one male collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Megachile ligniseca (Kirby, 1802)
One male collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Megachile willughbiella (Kirby, 1802)
Two males collected by C.W. Plant on 5 July 1996 in the Silver Garden, one female taken in the Malaise trap sample for 7 – 20 May 1995 and one female taken in the Malaise trap sample for 20 May – 23 June 1995.

APINAE

Nomada flava Panzer, 1798
Four females taken in the Malaise trap sample for 23 May – 6 June 1996 and two females taken in the Malaise trap sample for 24 April – 15 May 1997.

Nomada flavoguttata (Kirby, 1802)
One female taken in the Malaise trap sample for 6 – 18 June 1996, one female taken in the Malaise trap sample for 18 – 27 June 1996 and one female taken in the Malaise trap sample for 24 April – 15 May 1997.

Nomada goodeniana (Kirby, 1802)
Two males taken in the Malaise trap sample for 11 – 25 April 1996 and one male in a sample dated 16 April 1997.

Nomada ruficornis (Linnaeus, 1758)
Two males and two females taken in Malaise trap samples during 1997.

Anthophora plumipes (Pallas, 1772)
Nineteen males and five females taken in Malaise trap samples during 1996 and 1997.

Bombus hortorum (Linnaeus, 1761)
Eleven males, eight queens and eleven workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus lapidarius (Linnaeus, 1758)
One male, three queens and five workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus lucorum (Linnaeus, 1761)
One male, twenty-three queens and twenty-six workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus pascuorum (Scopoli, 1763)
Common in Malaise trap samples between May and September during 1995 and 1996, less frequent in samples during 1997.

Bombus pratorum (Linnaeus, 1761)
Ten males, eleven queens and fifteen workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus terrestris (Linnaeus, 1758)
One male, eleven queens and seventeen workers taken in Malaise trap samples during 1995, 1996 and 1997.

Apis mellifera Linnaeus, 1758
Twenty-six workers taken in Malaise trap samples during 1995 and 1997.

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The sawflies (Hymenoptera: Symphyta) of Buckingham Palace Garden

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Abstract

A survey of sawflies (Hymenoptera: Symphyta) occurring in The Garden at Buckingham Palace during 1995-98 produced a total of 31 species, with one additional species added in 2000. The species assemblage contains a high proportion of those likely to occur as garden pests.

Introduction and methods

The Garden was visited on 13 August 1997, 9 September 1997 and 1 June 1998 and specimens were also received from a Malaise trap sited on The Mound from 20.iv.1995 to 18.viii.1997. The mown lawn areas of Buckingham Palace Garden were judged likely to support few sawflies, but the flower beds, semi-wild areas and the lake margins all provide habitats for the plant-feeding larvae of these insects.

Sawflies were collected during the visits by sweeping vegetation with a net and by searching plants for larvae or signs of feeding activity. Wild and cultivated plants known to have sawflies associated with them were targeted for close attention. Identifications of adult insects were made using the keys of Benson (1952 and 1958) and Quinlan and Gauld (1981). Some larval stages were identifiable by their appearance or the distinctive feeding damage that they cause on certain host plants. Other larvae were retained and, where possible, they were reared through to the adult stage to ensure correct identification.

Results

During the 1995-98 period of the survey, 31 species of sawfly were identified as either adults or larvae, or from evidence of larval feeding. Of these, ten were recorded in the Malaise trap only, 16 by sweeping for adults and searching for larvae or feeding damage, and five species were recorded by both methods. Twelve of these are commonly found in gardens as pests of cultivated plants (Alford, 1991). Most of the sawflies recorded are common species found widely in Britain, but two species, *Neurotoma saltuum* and *Pristiphora geniculata*, are of local occurrence. The former was noted after the formal survey period ended, but is included in the species list.

Discussion

During the previous survey, conducted in the early 1960s, sawflies were not specifically recorded, although four species were casually noted as leaf-mines, galls or larvae (Richards 1964). Two of these species, *Heterarthrus vagans* and *Nematus caeruleocarpus*, were not seen during the current survey. For a garden the size of that at the Palace, and with its diversity of plants, a total list of 34 species is not large. More extensive collecting in the spring-midsummer period would almost certainly increase the list, as there is a number of common species that have not yet been recorded. Some quite large genera, such as *Empria, Macrophya, Tenthredo, Amauronematus* and *Pachynematus* have no representative recorded at the Palace, although some species in these genera are common species and likely to be present.

An annotated list of Symphyta recorded in Buckingham Palace Garden

The sequence of species and nomenclature follow Liston (1995); where names have changed from those given in the identification keys, the latter name is given in square brackets after the current name. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

HYMENOPTERA: SYMPHYTA

PAMPHILIIDAE

PAMPHILIINAE

Neurotoma saltuum (L., 1758) The Social Pear Sawfly.

Recorded as larvae on *Crataegus monogyna* by Mark Lane in July 2000. This species has orange-yellow gregarious larvae that live in a communal silk web. It is of widespread occurrence in southern England, but infrequently seen. It also feeds on pear foliage, hence its common name, and so is as likely to be found in gardens as in the countryside.

ARGIDAE

ARGINAE

Arge pagana (Panzer, 1798)

One of the large rose sawflies. Larvae were found on a wild rose, *Rosa* sp., on The Mound, 9.ix.1997 — adult emerged 4.vi.1998. The gregarious larvae defoliate rose stems, as does the very similar *A. ochropus*, which was not found during the survey. *A. pagana* has become much more abundant during the latter half of the 1990s.

TENTHREDINIDAE

DOLERINAE

Dolerus aeneus Hartig, 1837

A common grassland species with larvae likely to be feeding on *Poa* spp. in the Palace Garden. One male in the Malaise trap, 22.v-6.vi.1996.

Dolerus niger (L., 1767)

A common grassland species with larvae feeding on various grasses. One female in the Malaise trap, 15.v-19.vi.1997.

Aneugmenus padi (L., 1758)

A common sawfly with larvae on ferns, especially bracken, *Pteridium aquilinum*. A female in the Malaise trap, 20-28.vii.1995.

Selandria serva (Fabr., 1793)

A common sawfly in damp grassland. Males swept near The Lake on 13.viii.1997 and 1.vi.1998. The larva feed on various grasses and sedges.

BLENNOCAMPINAE

(*Heterarthrus vagans* (Fallén, 1808))

Mines in the leaves of alder, *Alnus glutinosa*, identified by K. A. Spencer, were recorded in the earlier survey, but this species was not detected during 1995-98. It is likely that it occurs still in the Palace Garden as it is a fairly common sawfly and there is adequate alder around The Lake.

Phymatocera aterrima (Klug, 1816) Solomon's Seal Sawfly.

Identified from oviposition scars and larval feeding damage on its host plant, *Polygonatum hybridum*, near The Waterfall, on 13.viii.1997.

Blennocampa phyllocolpa Viitasaari & Vikberg, 1985 [= *B. pusilla* Klug] Rose Leaf-rolling Sawfly.

A common sawfly on wild and cultivated roses, recorded as larval leaf-rolls, on 13.viii.1997.

Halidamia affinis (Fallén, 1807)

A widespread sawfly with larvae feeding on goosegrass, *Galium aparine*. A female in the Malaise trap, 7-20.v.1995.

* *Fenusa dohrnii* (Tischbein, 1846)
Identified by K. A. Spencer in the earlier survey, this common leaf-miner on *Alnus glutinosa* was found on alders around The Lake. Mined leaves were collected 13.viii.1997 and adults emerged later that month.

ALLANTINAE

Athalia cordata Lepeletier, 1825
A common species with larvae feeding on bugle, *Ajuga reptans*. A male was swept at The Waterfall end of The Lake on 13.viii.1997 and a female was taken in the Malaise trap, 20-28.vii.1995.

A. liberta (Klug, 1815)
A common species with larvae feeding on various wildflowers of the Cruciferae family. Two females in the Malaise trap, 20.v-23.vi.1995.

Caliroa cerasi (L., 1758) Pear and Cherry Slugworm.
A common garden species that skeletonises the foliage of *Prunus, Pyrus* and some other Rosaceae trees and shrubs. Larvae were found on cherry, *Prunus* sp., leaves near The Lake, 13.viii.1997.

C. varipes (Klug, 1816)
A common species, with larvae that skeletonise the foliage of *Quercus, Salix* and *Betula*. Larvae were found on the foliage of oak, *Quercus robur*, in the Nursery Yard on 13.viii.1997; a female was reared on 16.vi.1998.

Monostegia abdominalis (Fabr., 1798)
A widely distributed species near ponds, lakes and waterways where the larvae eat the foliage of yellow loosestrife, *Lysimachia vulgaris*. Larvae were found on the host plant by The Lake margin on 9.ix.1997 and a female was found 1.vi.1998.

Ametastegia carpini (Hartig, 1837) [= *Protoemphytus carpini*] The Geranium Sawfly.
The larvae eat holes in the foliage of wild and cultivated *Geranium* spp. Larvae were found on *Geranium pratense* in flower beds by the Back Path behind The Mound on 13.viii.1997.

TENTHREDININAE

Eriocampa ovata (L., 1761)
A common species that feeds as larvae on alder, *Alnus glutinosa*. Larvae and an adult female were seen 13.viii.1997 on alders by The Lake.

Tenthredopsis litterata (Geoffroy, 1785)
A common species, with larvae that feed on various grasses. Three females were collected in the Malaise trap during June-July 1995.

T. nassata (L., 1767)
A common species with habits similar to *T. litterata*. One female was taken in the Malaise trap in June 1995.

Pachyprotasis rapae (L., 1767)
A common species with polyphagous larvae. Seven females were taken in the Malaise trap during May-June 1996, three males and two females during May-June 1997 and one female was swept 1.vi.1998.

NEMATINAE

Priophorus pallipes (Lepeletier, 1823)
A common species with larvae feeding on the foliage of various Rosaceae trees and shrubs. A male and female were taken in the Malaise trap in June 1995.

P. rufipes (Lepeletier, 1823)
One of the more abundant sawflies in the Palace Garden in terms of numbers captured in the Malaise trap. The larvae feed on elm leaves, *Ulmus procera*. One male was recorded in June 1995, three males in 15.v-19.vi.1997 and 17 males and one female in 18.vii-13.viii.1997.

Trichiocampus ulmi (L., 1758) [= *Priophorus ulmi* L.]
Similar in habits to *P. rufipes*, but less common. One female and two males in the Malaise trap during 15.viii-5.ix.1995.

Cladius pectinicornis (Geoffroy, 1785)
A common sawfly with larvae that feed on rose leaves, *Rosa* spp. Two males in the Malaise trap, 20.v-23.vi.1995 and another male swept on 1.vi.1998.

Hoplocampa testudinea (Klug, 1816) The Apple Sawfly
The larvae feed inside the developing fruitlets. Signs of larval feeding in the fruits were seen on apples growing in the old orchard on 13.viii.1997 and 1.vi.1998.

Pristiphora aquilegiae (Vollenhoven, 1866) [= *P. alnivora* (Hartig)], The Aquilegia Sawfly
A widespread garden pest with larvae that can defoliate *Aquilegia* spp. Larvae were found on *Aquilegia* plants on 13.viii.1997 and a male was swept on 1.vi.1998.

P. armata (Thomson, 1862) [= *P. crassicornis* (Hartig)]
A widespread species, with larvae that feed on hawthorn, *Crataegus monogyna*. The Malaise trap recorded a male and female in June 1995, one male for 15.v–19.vi.1997, and a male was swept on 1.vi.1998.

P. geniculata (Hartig, 1840) The Mountain Ash Sawfly
A local but widespread sawfly in southern England. The gregarious larvae can defoliate mountain ash, *Sorbus aucuparia* and other *Sorbus* spp. with pinnate leaves. This sawfly was present on many of the pinnate-leaved *Sorbus* trees at the Palace and was causing significant damage to some of the smaller trees. Larvae were seen on 13.viii.1997 and 1.vi.1998.

* *Pontania proxima* (Lepeletier, 1823)
Galls on *Salix blanda* were recorded in the earlier survey. Galls believed to be of this species were found on *Salix alba* on 9.ix.1997, but no adults were reared. It is a common species.

(*Nematus caeruleocarpus* Hartig, 1837)
Identified by R. B. Benson in the earlier survey from larvae on *Salix* sp.

N. pavidus Lepeletier, 1823
A common sawfly that sometimes defoliates willows, *Salix* spp. A female was reared on 22.vi.1998 from larvae collected 1.vi.1998 on *Salix cinerea*. Similar larvae were found on 13.viii.1997, but no adults were reared.

N. spiraeae Zaddach, in Brische & Zaddach, 1882 The Aruncus Sawfly
A widespread garden pest of *Aruncus dioicus*, capable of causing complete defoliation. Larvae were found near The Waterfall on 13.viii.1997.

N. tibialis Newman, 1837 The False Acacia Sawfly
Like its host plant, *Robinia pseudoacacia*, this sawfly is an introduction from North America. It is of widespread occurrence in urban areas of England and was the most abundant species in the Malaise trap. It is an entirely female species; nine were taken in the trap for 7.v-10.x.1995, ten for 11.vii-15.viii.1996 and 14 for 15.v-13.viii.1997. Larvae were found on *Robinia pseudoacacia* leaves on 13.viii.1997 and an adult was swept on 1.vi.1998.

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The beetles (Coleoptera) of Buckingham Palace Garden

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Abstract

Coleoptera were collected between 1995 and 1998 at Buckingham Palace Garden. A total of 244 species was recorded. Comparisons are drawn with an earlier survey some forty years previously and an annotated list of the 287 species recorded in both surveys is presented. Though it is not possible to say that all species have been recorded at any site, this total is considered to be close to the maximum number likely to be present in this habitat in the centre of a large urban conurbation.

Introduction

The first beetle records from Buckingham Palace Garden are apparently those of F. D. Buck and E. G. Gardner (Buck 1964), who carried out a survey between 1960 and 1963, recording 91 species (not 87 as stated by Buck in his Introduction). They collected in the Garden together, though the paper was written by Buck alone so the present work refers to their list as his. Their findings were the result of hand-searching backed up by beating and sweeping where possible. They also had the use of a mercury-vapour lamp, which produced several records, but they did not employ a Malaise trap or any pitfall traps. Despite these handicaps, as they might be considered today, they produced a list of 91 species. The 1995 to 1998 survey records 244 species, of which 48 were rediscoveries of species found in the earlier work, so that the overall total of beetles recorded from the Garden is 287 — about 7 per cent of the British beetle fauna. This total is, in all probability, not far short of the actual number that might be expected in an ornamental garden at the centre of a large conurbation.

Collecting methods

Active sampling

A total of twelve visits was made by me to the Garden specifically to search for beetles; these visits were made during the months of April to September in 1997 and 1998. In addition, visits by Professor John Owen and Richard Jones, specialising in other taxa, took place throughout the study period covering every month of the year. Finally, occasional beetle specimens encountered by other members of the survey team, and by the gardening staff, were passed on to me through the agency of Colin Plant.

Hand-sieving of grass, moss, rotting fungus and especially goose droppings yielded many species. Care was taken to sample both the fresh goose droppings on the lawn areas and older material in deeper piles on the islands. The vegetable refuse and horse dung (from the Royal Mews) at the Recycling Centre was regularly sieved, with the fine sievings usually taken away from the Garden for closer scrutiny. On one special occasion, the garden staff kindly removed the heavy wooden covers from the children's sandpit to enable us to collect the beetles underneath.

Beating trays were used, with discretion, on certain flowering trees and shrubs whilst sweep nets were also used on the few areas where the grass was sufficiently tall.

The Lake, including in the central area, was extensively hand-netted by Colin Plant, wearing chest-waders, on 20 October 1995, but in spite of this exercise producing seven species of aquatic Heteroptera the only beetle encountered was a single, dead *Trechus obtusus* that had evidently fallen in and drowned. There were no water beetles. Intensive sampling carried out around the edge and by examining submerged plants on 11 May 1998 also produced no true water beetles, though the area in close proximity proved to be rich in other groups, particularly when sieving moss and splashing the bank with water. There was a notable absence of aquatic plants and together with the high population of waterfowl this seems to indicate minimal entomological interest. The situation must have been the same at the time of the earlier survey, since Buck lists only two water beetles (*Ilybius fuliginosus* and *Haliplus immaculatus*) in spite of Gardner's interest in the group.

Passive sampling

A Malaise trap was operated on The Mound [see map on pages 2 & 3, grid square 09 — *Ed.*], for the entire duration of the survey. Samples from the trap were all passed to Colin Plant, who sorted and extracted the various taxa and passed them to the identifiers. This generated a number of useful records of beetles.

Pitfall traps set by Colin Plant were operated at six stations, also for the full term of the survey, and again beetles were sorted and passed to me by him. A smaller number of pitfall traps were set by Edward Milner to catch spiders and these, too, yielded a few beetles. Professor John Owen set a number of subterranean pitfall traps, consisting of a wire-mesh tube containing sherry as an attractant (*vide* Owen 1995). Although these added several interesting species to the list, Prof. Owen informs me that they were not as productive as they had been in certain other gardens, particularly in Surrey, where their use has revealed several species of blind, subterranean beetles to be much more common than was previously thought.

A small number of specimens was also made available from the mercury-vapour light trap operated for Lepidoptera by David Carter. Finally, small net bags containing old potatoes, then buried in the soil of selected flower beds, also provided several useful records.

Discussion

It is now forty years since the first survey of the Garden by Buck and Gardner, and during that time many great changes must have taken place in this dynamic environment, both in terms of gardening practice and in the types of plants cultivated. These will surely have had a profound effect upon the invertebrate community including the beetles.

One aspect of gardening practice is the turning of garden refuse into compost. Compost heaps are of great ecological value, especially in an ornamental garden that is, overall, rather too tidy for many invertebrates. They provide an important refuge for many species, both as adults and as larvae, and it is of significance that 25 per cent of Buck's records from the earlier survey were from this habitat. Prior to 1991, most of the green garden refuse was sent out of the Garden, though some was retained as compost heaps. Since 1991, a sophisticated recycling centre has been in operation, taking not only garden refuse but also horse faeces from the Royal Mews. However, although attracting many beetles and providing a good place to collect, it is not as good as a simple compost heap where material is left to rot down over the course of time. For example, Buck (1963) states in his introduction that two of the commonest beetles in the garden were *Pterostichus madidus* and *Calathus fuscipes*, both of which he records from a compost heap (sometimes he writes heaps suggesting that there was more than one). We caught neither species at the Recycling Centre and few of either in the Garden throughout the period of the survey. In fact we found the ground beetles (Carabidae) to be poorly represented in the Garden in terms of numbers of individuals, although we increased the number of recorded species considerably, from 15 to 33. It may be that the unknown causes of the reduction in numbers are of a temporary nature, and that populations may rise again at some future date; whether the loss of traditional compost heaps is a significant factor in this is a matter which may be resolved in future surveys. It is surely difficult for this group of beetles, in such isolated populations, to be reinforced by individuals from outside the Garden in the same way as smaller insects that fly more readily, such as *Meligethes* and *Anaspis*.

Whilst the present survey records an increase in the numbers of species in nearly all recorded families since Buck's day, it is in those species which have an association with plants, particularly with flowers, that the increase is most apparent. Buck records few such species and suggested that spraying with insecticides might be the reason, pointing out that they would be in the front line and more vulnerable than ground-living species. He is probably correct. Such beetles have shown a considerable increase in the Garden as the use of harmful chemicals has been reduced to the bare necessity. Buck records far fewer Chrysomelidae, Curculionidae, *Anaspis* and *Epuraea*, for instance, than the present survey and a complete absence of *Meligethes* species. Yet *Meligethes aeneus* is, perhaps, the commonest beetle in the Garden today.

Not only is the number of species increased but also the number of individuals, often significantly. This may be partly a consequence of the planting of hawthorn (*Crataegus* spp.) in the garden, as this attracts large numbers of insects when it is in flower. Buck commented on the absence of the Cerambycidae from the Garden, so he would doubtless be pleased to see *Grammoptera ruficornis* in large numbers on the hawthorn blossom — hopefully a precursor to rarer members of this attractive family.

At least two nationally rare beetles (species listed in the *British Red Data Book* — *vide* Shirt 1987), have been recorded from the Garden — *Longitarsus ferrugineus* (Chrysomelidae) and *Clitostethus arcuatus* (Coccinellidae).

Longitarsus ferrugineus is listed by Hyman and Parsons (1992) as *Endangered — Red Data Book category 1*. It was taken by Eric Gardner during the first survey, on a patch of mint (*Mentha*) in The Yard. The mint has long gone from here, but the present Head Gardener, Mark Lane, took me to a patch on the island that looked most promising. Unfortunately it did not produce the beetle on that occasion, though it could easily be present since it has a habit of dropping off the plant the instant it senses the approach of an entomologist and becomes almost impossible to find amongst the detritus at the roots of the mint.

A single example of *Clitostethus arcuatus* was sorted by Colin Plant from the Malaise trap sample collected between 27 July and 3 August 1996 (Williams 2000). The beetle is also listed by Hyman and Parsons (1992) as *Endangered* and was similarly placed in *Red Data Book* category 1 by Shirt (1987). It is associated with ivy, *Hedera helix*, and it is no surprise as this plant grows near the Malaise trap. It has always been considered rare, but recent records from Malaise traps (Welch and Dukes 1999) suggest that it may be more widespread than previously thought. However, it remains a rarity and a most unexpected capture in the centre of London.

Of the 91 species recorded by the earlier survey, 48 per cent have been found in the recent field survey. Interestingly, this is approximately the same percentage exhibited by the spiders (Milner *antea* 87). Whilst we did not specifically search out the elusive species we did have them in mind when collecting in suitable places.

Finally, one species, in the form of the large tenebrionid *Blaps mucronata*, a species noted by Buck as being 'not uncommon' in the potting sheds, but not found by us, was recently discovered 'scaring the horses' in the stables at the Royal Mews, adjacent to the Garden, during 2000 by Mark Lane — just in time to be recorded on our list.

An annotated list of Coleoptera recorded in Buckingham Palace Garden

Species found in the earlier survey, but not found during the present study, are shown in parentheses whilst those recorded in both surveys are indicated by an asterisk. 'Red Data Book' and 'Notable' species are those listed by Hyman and Parsons (1992; 1994). Nomenclature broadly follows Pope (1977) though this has been updated in places; authorities are given for species names so that any confusion might be avoided. Reference to a record by Buck refers to Buck (1964) and the date is omitted from the citation for reason of both brevity and clarity. Comments on the London Area status of the Carabidae were provided by Paul Mabbott, the London Area recorder for that family.

COLEOPTERA

Carabidae

* *Nebria brevicollis* (Fabricius, 1792)
Four specimens in a pitfall trap near The Stoneyard. Buck recorded it from stacked turfs. Common in the London Area.

Nebria salina Fairmaire & Laboulbène, 1856
A single specimen taken by Richard Jones at the edge of The Sandpit. Rare in the London Area.

* *Notiophilus biguttatus* (Fabricius, 1779)
The occasional specimen in pitfall traps in several parts of the Garden and under stones near The Recycling Centre. Buck records a single specimen running on the ground. Common in London.

Notiophilus palustris (Duftschmid, 1812)
A single specimen taken near The Stoneyard running in the sun. Common around London.

Clivina collaris (Herbst, 1784)
One specimen in a pitfall trap near The Tea House. Common around London.

Trechus obtusus Erichson, 1837
One example in a pitfall trap near The Waterfall. Not uncommon in the London Area.

* ?*Asaphidion curtum* (Heyden, 1870)
Several in pitfall traps and under stones. Not recorded under this name by Buck, however *A. flavipes* is recorded and this species was later split into three, one of which is *curtum*. Rather local around London, in damp areas.

Bembidion lampros (Herbst, 1784)
Five specimens under old wood and stones at The Stoneyard. Common in and around London.

* *Bembidion tetracolum* Say, 1823
Several in a pitfall trap near The Stoneyard. Buck records it from The Lakeside.

Bembidion guttula (Fabricius, 1792)
One specimen in the Malaise trap. Common in wet places around London.

Bembidion lunulatum (Fourcroy, 1785)
One specimen in the Malaise trap. Common in wet places around London.

Stomis pumicatus (Panzer, 1795)
Four specimens in a pitfall trap near The Waterfall. Not uncommon in the London Area.

* *Pterostichus madidus* (Fabricius, 1775)
One in an underground pitfall trap, another in The Sandpit and a single specimen in a conventional pitfall trap. Taken by Buck and Gardner under shrubs and in large numbers in a compost heap. Very common in the London Area.

Calathus erratus Sahlberg, C. R., 1827
A single specimen in an underground pitfall trap. This is the first record for the London Area since 1956.

* *Calathus fuscipes* (Goeze, 1777)
Several specimens in various pitfall traps and one at The Sandpit. Recorded by Buck and Gardner as being in large numbers under turves and in compost heaps, since that time it appears to have declined. Very common in the London Area.

Calathus melanocephalus (Linnaeus, 1758)
A single specimen taken at the edge of The Sandpit. Not uncommon in the London Area.

Platyderus ruficollis (Marsham, 1802)
One specimen taken in the Malaise trap, fairly widespread in the London Area, Nationally notable (Nb.). Common in and around London.

(*Agonum albipes* (Fabricius, 1796) (as *Agonum ruficorne*))
Recorded by Buck from under stones by The Lake and on The Cascade (Waterfall) and not seen since. Common in wet places around London.

(*Agonum dorsale* (Pontoppidan, 1753))
Recorded by Buck from turves and compost heap and not seen since. A generally common species in the London Area.

* *Amara aenea* (Degeer, 1774)
One specimen taken in a pitall trap at The Stoneyard. Recorded by Buck with no further details. Very common in the London Area.

Amara anthobia Villa, 1833
Two specimens in a pitfall trap near The Stoneyard. A recent arrival in Britain and appears to be still spreading, found mainly on sandy areas in southern England. Common around London.

(*Amara aulica* (Panzer, 1796))
Recorded by Buck from the m.v. trap and not seen since. Common around London.

Amara familiaris (Duftschmid, 1812)
Two in the m.v. light trap. Common in the London area.

Amara lunicollis Schiodte, 1837
One in a pitfall trap at The Silver Garden. Common in the London Area.

Amara similata (Gyllenhal, 1810)
One in a pitfall trap near The Waterfall. Not uncommon in the London Area.

Harpalus rufipes (Degeer, 1774)
Only one specimen was taken in the Garden, in the Malaise trap. Common in gardens in the London Area, so it is curious that it appears to be scarce here. It could be a recent arrival as Buck did not record it.

* *Harpalus affinis* (Schrank, 1781)
Occasionally in pitfall traps. One specimen recorded by Buck and Gardner without further details. Generally common in the London Area.

Harpalus rufibarbis (Fabricius, 1792)
One taken in a pitfall trap at The Stoneyard. Common in the London Area.

(*Anisodactylus nemorivagus* (Duftschmid, 1812))
One specimen recorded by Buck, with no further details. Usually associated with dry sandy heaths. Possibly an odd specimen brought in with plants, an uncommon species classed Na. This is the only record for the London Area.

* *Bradycellus harpalinus* (Serville, 1821)
One in a pitfall trap near The Waterfall and another in a piece of wood on The Island. Taken by Buck and Gardner in a compost heap. Common in wet places around London.

(*Bradycellus verbasci* (Duftschmid, 1812))
Recorded by Buck with no further details. Not uncommon in the London Area.

Acupalpus dubius Schilsky, 1888
A single specimen was sieved from a mixture of grass and moss at the side of The Lake.

Badister bipustulatus (Fabricius, 1792)
Occasionally in pitfall traps. Common around London.

Dromius meridionalis Dejean, 1825
Three specimens in the m.v. light trap.

Metabletus foveatus (Fourcroy, 1785)
A single specimen in a pitfall trap at The Silver Garden. Very common in the London Area.

HALIPLIDAE

(*Haliplus immaculatus* Gerhardt, 1877)
Buck records two specimens under Iris roots in The Lake. Not seen during the present survey.

DYTISCIDAE

Ilybius ater (Degeer, 1774)
One in the m.v. light trap.

(*Ilybius fuliginosus* (Fabricius, 1792))
Buck records two specimens, one from The Lake and the other in the m.v. light trap.

Rhantus suturalis (MacLeay, 1825)
One in the m.v. light trap.

HYDROPHILIDAE

(*Helophorus granularis* (Linnaeus, 1761))
Several at m.v. light according to Buck.

* *Helophorus obscurus* Mulsant, 1844
One specimen in a pitfall trap near The Stoneyard. Buck records several at mercury vapour light. Frequent in ponds in the London Area.

Sphaeridium marginatum (Fabricius, 1787)
Several at The Recycling Centre in horse dung from the Royal Mews. Considered to be a synonym of *S. bipustulatum* for many years, but recently reinstated.

Sphaeridium lunatum Fabricius, 1792
Several specimens in dung at The Recycling Centre.

* *Cercyon analis* (Paykull, 1798)
Three specimens sieved from moss and grass around The Lake. Buck records it from vegetable refuse and litter by The Lake.

* *Cercyon melanocephalus* (Linnaeus, 1758)
Several at The Recycling Centre in vegetable refuse. Buck records it from a duck's nest.

Cercyon haemorrhoidalis (Fabricius, 1775)
Several specimens at Recycling Centre in vegetable refuse.

(*Cercyon quisquilius* (Linnaeus, 1761))
Recorded by Buck from mercury light.

Cercyon pygmaeus (Illiger, 1801)
One specimen taken in a pitfall trap near The Waterfall.

* *Megasternum obscurum* (Marsham, 1802)
Several taken in pitfall traps at various parts of the Garden and in vegetable refuse at The Recycling Centre. Recorded by Buck as being common in compost.

Cryptopleurum crenatum (Kugelann, 1794)
One specimen of this local but widespread species in an underground pitfall trap. A Nationally Notable species.

Cryptopleurum minutum (Fabricius, 1775)
Several at The Recycling Centre in vegetable refuse and one in an underground pitfall trap.

(*Anacaena globulus* (Paykull, 1798))
Recorded by Buck in cut grass against a fence bordering The Lake and not seen since.

HISTERIDAE

Kissister minimus (Aubé, 1850)
One specimen in an underground pitfall trap.

Paralister purpurascens (Herbst, 1792)
A single specimen in a pitfall trap near The Stoneyard.

PTILIIDAE

Ptenidium formicetorum Kraatz, 1851
Several specimens sieved from a rotted, fungoid tree stump on The Mound.

Ptinella aptera (Guérin-Méneville, 1839)
Several specimens taken with the above species.

Ptinella errabunda Johnson, 1975
Several specimens taken with the above species.

* *Acrotrichis atomaria* (Degeer, 1774)
Several specimens taken with the previous species. Buck records it in compost, vegetable litter and an old duck's nest.

LEIODIDAE

Ptomaphagus medius Rey, 1889
One specimen in a pitfall trap near The Waterfall.

Ptomaphagus subvillosus (Goeze, 1777)
Several specimens in pitfall traps in various parts of the Garden and in the Malaise trap. Four specimens trapped in an old potato buried in the ground near The Waterfall.

(*Sciodrepoides watsoni* (Spence, 1813) (as *Sciodrepa watsoni*))
Buck records a male and a female in an old duck's nest containing addled and broken eggs.

Catops nigricans (Spence, 1813)
One specimen in an old, rotten potato buried in the ground near The Waterfall.

STAPHYLINIDAE

Omalium italicum Bernhauer, 1902
One in the Malaise trap.

Omalium rivulare (Paykull, 1789)
One specimen in a pitfall trap near The Tea House and one in the Malaise trap.

* *Siagonium quadricorne* Kirby, W., 1815
Two in a pitfall trap near The Stoneyard and three in the Malaise trap. Buck found it common under bark of felled elm and holly boughs. He is not correct when he states (in his introduction) that it only ever occurs under the bark of these two trees. I have found it under several other types of bark, in the south of England including elder on one occasion.

Carpelimus elongatulus (Erichson, 1839)
Three examples taken in a pitfall trap near The Waterfall.

(*Anotylus complanatus* (Erichson, 1839))
Recorded by Buck from vegetable litter.

Anotylus clypeonitens (Pandellé, 1867)
One in the m.v. light trap. A generally uncommon species.

* *Anotylus tetracarinatus* (Block, 1799)
Several in garden refuse at The Recycling Centre. Buck records it from vegetable litter at The Lakeside.

* *Anotylus rugosus* (Fabricius, 1775)
Two in the Malaise trap. Buck records it from vegetable litter and compost.

* *Stenus brunnipes* Stephens, 1833
Two in a pitfall trap at The Tea House. Buck swept one by The Lake.

Stenus canaliculatus Gyllenhal, 1827
One specimen in the Malaise trap.

Stenus impressus Germar, 1824
One in the Malaise trap.

Stenus ossium Stephens, 1833
One in the Malaise trap.

Stenus pusillus Stephens, 1833
One sieved from moss and grass at the side of The Lake.

Lithocharis ochracea (Gravenhorst, 1802)
One specimen sieved from rotting fungi (*Grifola* sp.) on an old tree stump on The Mound.

Gyrohypnus angustatus Stephens, 1833
Several in rotting goose droppings on The Island and in fungus on The Mound.

Gyrohypnus punctulatus (Paykull, 1789)
Four specimens in a pitfall trap at The Silver Garden.

* *Xantholinus linearis* (Oliver, 1795)
Several specimens sieved from rotting fungus on an old tree stump on The Mound. Buck records it as being common in compost.

Philonthus cognatus Stephens, 1832
Several in the Malaise trap and regularly in pitfall traps in various parts of the Garden.

Philonthus concinnus (Gravenhorst, 1802)
One specimen in a pitfall trap at The Stoneyard.

Philonthus discoideus (Gravenhorst, 1802)
Several in vegetable refuse at The Recycling Centre.

Philonthus varians (Paykull, 1789)
Four specimens in a pitfall trap at The Fire Hole.

Philonthus varius (Gyllenhal, 1810)
Several in a pitfall trap near The Waterfall.

Gabrius pennatus Sharp, 1910
Two specimens taken in a pitfall trap near The Waterfall.

Staphylinus aeneocephalus Degeer, 1774
Occurred regularly in pitfall traps throughout the Garden. The commonest large Staphylinid in the Garden.

Staphylinus ater Gravenhorst, 1802
In pitfall traps, the Malaise trap and in an underground pitfall trap. This species, which occurs more frequently on or near the coast is not uncommon in the Garden.

* *Staphylinus olens* Muller, O. F., 1764. The 'Devil's Coach Horse'
A few specimens in pitfall traps and one in an underground pitfall trap, not common. Buck records it from turves.

Ocypus morsitans Rossi, 1790 (=*Staphylinus compressus*)
One specimen sieved from moss and grass at The Lake.

Quedius curtipennis Bernhauer, 1908
One in an old duck's nest on The Island.

(*Quedius tristis* (Gravenhorst, 1802) (as *Quedius laevicollis*))
Buck records this species from turves.

Quedius mesomelinus Marsham, 1802
One specimen in the Malaise trap.

(*Quedius molochinus* (Gravenhorst, 1806))
Buck records this species from turves.

* *Quedius semiaeneus* (Stephens, 1833)
Not uncommon in vegetable refuse at The Recycling Centre. Buck records it from vegetation, litter and turves.

* *Quedius semiobscurus* (Marsham, 1802)
Several in pitfall traps and at The Recycling Centre. Recorded by Buck from vegetable litter.

Quedius schatzmayri Gridelli, 1922
Several in the Malaise trap on two occasions and a single specimen in a pitfall trap near The Silver Garden.

(*Habrocerus capillaricornis* (Gravenhorst, 1806))
Recorded by Buck from compost, and not seen since. Common in the London Area.

Mycetoporus splendidus (Gravenhorst, 1806)
One male sieved from moss and grass from beside The Lake.

Bolitobius analis (Fabricius, 1787)
One specimen in a pitfall trap near The Stoneyard and another in the Malaise trap.

Sepedophilus marshami (Stephens, 1832)
One in a pitfall trap near The Tea House.

* ? *Tachyporus dispar* (Paykull, 1789)
In pitfall traps, the Malaise trap and grubbing about in moss and at roots in the Garden. Common. Buck records *Tachyporus chrysomelinus,* but the record might refer to *dispar* which has now been separated from *chrysomelinus.*

* *Tachyporus hypnorum* (Fabricius, 1775)
Common in the garden in pitfall traps, the Malaise trap, in moss at the side of The Lake and beating hawthorn blossom. Buck records it from compost and vegetable litter.

(*Tachyporus formosus* Matthews, A. H., 1838)
Recorded by Buck from compost and not seen since. Classed as Nationally Notable (Na).

Tachyporus pusillus Gravenhorst, 1806
Several in pitfall traps and in old goose droppings on The Island.

Tachyporus solutus Erichson, 1839
A single specimen in the Malaise trap.

Tachyporus nitidulus (Fabricius, 1781)
A few specimens in pitfall traps and one in moss at the side of The Lake. Not common in the Garden.

(*Tachyporus pallidus* Sharp, 1871)
Recorded by Buck in an old duck's nest containing broken and addled eggs.

Tachinus signatus Gravenhorst, 1802
One in the Malaise trap. A common species in the London Area and elsewhere but seemingly scarce in the Garden.

Cilea silphoides (Linnaeus, 1767)
Common in rotting vegetation and horse dung at The Recycling Centre.

Cypha longicornis (Paykull, 1800)
A few specimens in various pitfall traps, also by grubbing around in moss and grass near The Lake. Odd specimens in the sweep net and beating tray.

Oligota parva Kraatz, 1862
Common in vegetable refuse and dung at The Recycling Centre. Generally common in the London Area in compost and particularly lawn mowings.

Oligota pumilio Kiesenwetter, 1858
Common at The Recycling Centre in vegetable refuse. Generally common in the London Area in compost heaps.

Leptusa ruficollis (Erichson, 1839)
A single specimen in the Malaise trap. The beetle is usually found under loose bark, often with dry fungus.

Autalia rivularis (Gravenhorst, 1802)
One only in the Malaise trap.

Aloconota gregaria (Erichson, 1839)
Several in pitfall traps in various parts of the Garden and occasionally in the Malaise trap.

Amisha decipiens (Sharp, 1869)
Several at The Recyling Centre in vegetable refuse and horse dung. It is surprising that the more common *A. analis* has not been taken in the Garden.

Dinaraea aequata (Erichson, 1837)
Several in a pitfall trap near The Waterfall and in an old potato buried in the ground nearby.

Plataraea brunnea (Fabricius, 1798)
One taken in a pitfall trap near The Stoneyard.

Atheta amicula (Stephens, 1832)
One specimen in moss and grass at the side of The Lake.

Atheta atramentaria (Gyllenhal, 1810)
Several in an old rotting potato buried in the ground near The Waterfall. In goose droppings on The Main Lawn and on The Island.

* *Atheta crassicornis* (Fabricius, 1792)
Several specimens in goose droppings, Malaise trap, pitfall traps in various parts of the Garden and a single example in an underground pitfall trap. Common. Buck records it from compost.

Atheta coriaria (Kraatz, 1856)
Several in vegetable refuse at The Recycling Centre and in a pitfall trap near The Silver Garden.

* *Atheta fungi* (Gravenhorst, 1806)
A few examples in pitfall traps in various parts of the Garden and grubbing around The Lake in moss and grass. Several in rotting fungus on The Mound. Buck records it from vegetable litter and compost.

(*Atheta hygrotopora* (Kraatz, 1856))
Recorded by Buck from compost. Not the usual habitat for this species which would be more in context in damp areas around The Lake.

Atheta elongatula (Gravenhorst, 1802) v. *balcanica* Brùndin, 1944 (*nec* Bernhauer, 1936)
One in the m.v. light trap.

? (*Atheta dadopora* Thomson, C. G., 1867) (as *Atheta arenicola*)
Recorded by Buck from vegetable litter.

? (*Atheta nigra* (Kraatz, 1856) (as *Atheta zosterae*))
Recorded by Buck from compost.

Atheta indubia (Sharp, 1869)
Common in goose droppings on The Main Lawn and on The Island.

* *Atheta laticollis* (Stephens, 1832)
Several specimens in pitfall traps in various parts of the Garden, vegetable refuse and rotting fungus on The Mound. Buck records it from compost.

* *Atheta longicornis* (Gravenhorst, 1802)
Common in goose droppings around The Lake. Buck records it from compost.

Atheta nigricornis (Thomson, C. G., 1852)
Four specimens in the Malaise trap. Usually found in birds' nests in hollow trees.

Atheta nigripes (Thomson, C. G., 1856)
Common in well rotted goose droppings on The Island.

Atheta muscorum (Brisout, 1860)
Common at The Recycling Centre in vegetable refuse and in fungus on The Mound.

* *Atheta sordidula* (Erichson, 1837)
Several in rotting goose droppings on The Island. Recorded by Buck from vegetable litter.

Atheta trinotata (Kraatz, 1856)
Common in vegetable litter at The Recycling Centre.

Atheta triangulum (Kraatz, 1856)
Regularly in pitfall traps in several parts of the Garden, the Malaise trap and in old goose droppings on The Island.

(*Atheta pygmaea* (Gravenhorst, 1802))
Recorded by Buck from compost and not seen since.

(*Atheta subsinuata* (Erichson, 1839))
Buck records this species from compost and it has not been seen since.

Atheta xanthopus (Thomson, C. G., 1856)
A few specimens in a pitfall trap near The Stoneyard and in an underground pitfall trap.

* *Atheta aterrima* (Gravenhorst, 1802)
A few specimens in goose droppings on The Main Lawn. Recorded by Buck from compost.

Atheta clientula (Erichson, 1839)
One in the m.v. light trap.

Nehemitropia sordida (Marsham, 1802)
Common in vegetable refuse at The Recycling Centre, a few specimens in goose droppings on the Island and one in an underground pitfall trap.

Oxypoda brachyptera (Stephens, 1832)
Two examples in a pitfall trap near The Tea House.

Oxypoda exoleta Erichson, 1839
A single specimen of this uncommon beetle was sieved from vegetable refuse at The Recycling Centre by John Owen. Classified as Nationally Notable.

Oxypoda haemorrhoa (Mannerheim, 1830)
Three specimens in a pitfall trap near The Tea House and another in an underground pitfall trap.

Oxypoda opaca (Gravenhorst, 1802)
One only in the Malaise trap.

Oxypoda umbrata (Gyllenhal, 1810)
Several in pitfall traps in various parts of the Garden and one in an underground pitfall trap.

Tinotus morion (Gravenhorst, 1802)
One in the Malaise trap and several in rotting goose droppings on The Island.

Aleochara bipustulata (Linnaeus, 1761)
One in the Malaise trap.

Aleochara intricata Mannerheim, 1831
Several in the Malaise trap.

Aleochara lanuginosa Gravenhorst, 1802
Several in the Malaise trap.

Aleochara sparsa Heer, 1839
One in the Malaise trap. Associated with bird's nests in trees and not uncommon in the London parks.

PSELAPHIDAE

Euplectus infirmus Raffrey, 1910
Several specimens sieved from an old rotten tree stump on The Mound.

LUCANIDAE

Lucanus cervus (Linnaeus, 1758) The Stag Beetle
Several sightings over the past few years according to the gardeners and larvae attributed to this species were found in an old tree stump a few years back. Classified as Nationally Notable (Nb.).

SCARABAEIDAE

Aphodius prodrimus (Brahm, 1790)
A single specimen in a pitfall trap near The Fire Hole.

(*Aphodius rufipes* (Linnaeus, 1758))
Buck records a single specimen from a m.v. trap.

Aphodius sphacelatus (Panzer, 1798)
Four specimens in goose droppings on The Main Lawn.

* *Melolontha melolontha* (Linnaeus, 1758)
One specimen in the Malaise trap. Buck records a single example without any details.

Serica brunnea (Linnaeus, 1758)
Occasionally in the Malaise trap.

BYRRHIDAE

Simplocaria semistriata (Fabricius, 1794)
One in a pitfall trap near The Tea House.

Byrrhus pilula (Linnaeus, 1758)
Occasionally in pitfall traps in several parts of the Garden and several at the edge of The Sand Pit when the cover was removed.

HETEROCERIDAE

Heterocerus fenestratus (Thunberg, 1784)
One example in the Malaise trap. Probably from a colony living somewhere at the side of The Lake where they burrow in soft mud.

BUPRESTIDAE

Agrilus sinuatus (Olivier, 1790)
Emergence holes of this attractive species were discovered in a dead hawthorn on The Island by Richard Jones, who states that the beetle is widespread in the London Area (judging by the number of emergence holes) but adults are very elusive. Classed as Nationally Notable (Nb.).

ELATERIDAE

Agriotes pallidulus (Illiger, 1807)
One in the m.v. light trap. Common in the London Area.

Athous campyloides Newman, 1833
Several in pitfall traps in various parts of the Garden. Occurs regularly in the London Area. Classed as Nationally Notable (Nb.).

(*Athous bicolor* (Goeze, 1777))
Recorded by Buck from specimens taken in a m.v. trap.

Athous haemorrhoidalis (Fabricius, 1801)
Three specimens in the Malaise trap.

Agriotes sputator (Linnaeus, 1758)
Several in pitfall traps in various parts of the Garden.

(*Dalopius marginatus* (Linnaeus, 1758))
Buck records it from m.v. light.

Melanotus erythropus (Gmelin in Linnaeus, 1789)
Two in the m.v. light trap.

THROSCIDAE

Trixagus carinifrons (de Bonvouloir, 1859)
Common in pitfall traps in many parts of the Garden and in the Malaise trap.

Trixagus dermestoides (Linnaeus, 1767)
One only in the Malaise trap (and nearly overlooked).

CANTHARIDAE

Cantharis lateralis Linnaeus, 1758
One in the m.v. light trap.

* *Rhagonycha fulva* (Scopoli, 1763)

A few specimens in the Malaise trap. (A family that we found to be poorly represented in the Garden and one of the few that Buck and Gardner recorded more species than we did.) Buck records it from m.v. light.

(*Rhagonycha femoralis* (Brullè, 1832) (as *Rhagonycha limbata*))

Buck records this species as being swept, with no further details.

(*Rhagonycha testacea* (Linnaeus, 1758))

Buck records this species by sweeping, no further details.

(*Malthodes marginatus* (Latreille, 1806))

Buck records a single specimen at m.v. light.

DERMESTIDAE

Dermestes haemorrhoidalis Kuster, 1852

One specimen in the m.v. light trap. Recorded by Buck from m.v. light in the earlier survey.

Ctesias serra (Fabricius, 1792)

Larvae of this curious beetle found under the bark of plane and hawthorn where it feeds upon dead arthropods caught in spiders' webs, the larvae being seen more often than the adults. Widespread in the London Area, especially in old parks. Classed as Nationally Notable (Nb). Not recorded by Buck, which is surprising, but might be due to the gardeners' likely reluctance to having bark taken from the trees.

Anthrenus verbasci (Linnaeus, 1767)

Regularly swept from flowers and in the Malaise trap.

ANOBIIDAE

Stegobium paniceum (Linnaeus, 1758)

One specimen in the Malaise trap. Occurs in pantries and storehouses where the larvae feed on stored foods particularly cereals. Widespread in London.

MELYRIDAE

Dasytes aeratus Stephens 1830

Several on one occasion in the Malaise trap.

(*Dasytes plumbeus* (Muller, O. F., 1776))

One specimen recorded by Buck from Umbelliferae at The Lakeside, Classified Nationally Notable (Nb.).

NITIDULIDAE

Brachypterus glaber Stephens, 1825

One in a pitfall trap near The Tea House. The species is associated with the common stinging nettle, not a common plant in the Garden.

Meligethes aeneus (Fabricius, 1775)

Very common on flowering plants, probably the commonest beetle in the Garden and apparently a recent arrival as it is not recorded by Buck. Very common in the London Area.

Meligethes nigriscens Stephens, 1830

Four specimens in the Malaise trap.

Epuraea aestiva (Linnaeus, 1758)

Common on hawthorn blossom in particular but also on other flowering plants including daffodils.

RHIZOPHAGIDAE

Rhizophagus parallelocollis (Gyllenhal, 1827)

One specimen taken in an underground pitfall trap. Outside the Garden it is known as 'the graveyard beetle' and is reported on occasions to swarm on graves and corpses buried at some depth in the ground, as well as sap and in rotting fungus.

Rhizophagus perforatus Erichson, 1845
Several records from the Garden including one in an underground pitfall trap, several in a rotting potato buried in the ground and four in a pitfall trap near The Waterfall.

Monotoma picipes Herbst, 1793
Common in vegetable refuse at The Recycling Centre.

CRYPTOPHAGIDAE

Crytophagus scanicus (Linnaeus, 1758)
One in the Malaise trap.

(*Cryptophagus acutangulus* (Gyllenhal, 1827))
Buck records it from an old duck's nest containing addled and broken eggs.

* *Cryptophagus setulosus* Sturm, 1845
Several in pitfall traps in various parts of the Garden and one in an underground pitfall trap. Buck records it from compost.

(*Cryptophagus angustus* Ganglbauer, 1899)
Buck records this species from compost. Classified as Notable.

* *Atomaria atricapilla* Stephens, 1830
One in a pitfall trap at The Silver Garden and a few specimens sieving moss and grass at the side of The Lake. Buck records it as being common in compost.

* *Atomaria fuscata* (Schoenherr, 1808)
A few specimens sieved from moss and grass around The Lake. Buck records it from a similar situation and also in 'humus below rocks'.

(*Atomaria rubella* Heer, 1841 (as *Atomaria bicolor*))
Buck records this species as being common in compost.

Atomaria gutta (Newman, 1834)
Several specimens on one occasion in a pitfall trap near The Silver Garden.

Atomaria lewisi Reitter, 1877
Three specimens sieved from rotting fungi on an old tree stump at The Mound.

Ephistemus globulus (Paykull, 1798)
Recorded by Buck from vegetable litter at The Lakeside.

* *Atomaria testacea* (Stephens, 1830)
Common on several occasions at The Recycling Centre in vegetable refuse. Buck records it from vegetable litter at The Lakeside.

PHALACRIDAE

Olibrus affinis (Sturm, 1807)
Taken many times in the Malaise trap and general sweeping. Once in large numbers by sweeping clover at The Mound.

CERYLONIDAE

Anommatus duodecimstriatus (Muller, P. W. J., 1821)
A single specimen of this uncommon subterranean beetle, often associated with old potatoes buried in the soil, was taken in an underground pitfall trap. Classified as Nationally Notable (Na.).

CORYLOPHIDAE

Sericoderus lateralis (Gyllenhal, 1827)
Several on the soil around a large poplar tree on The Island.

COCCINELLIDAE

Rhyzobius litura (Fabricius, 1787)
In pitfall traps and the Malaise trap. Several on hawthorn blossom and occasionally by grubbing at roots around The Lake.

No Recipient, Fwd: BP beetle

To:
From: Martin Honey <mrh@nhm.ac.uk>
Subject: Fwd: BP beetle
Cc:
Bcc:
Attached:

To: alexwilliams29@hotmail.com
From: Martin Honey <mrh@nhm.ac.uk>
Subject: BP beetle

Hi Alex

Another beetle that has apparently not been recorded previously from Buckingham Palace :

Coccinellidae

Anatis ocellata (Linnaeus, 1758) the Eyed Ladybird

One to light 4.ix.2003

(*Coccidula rufa* (Herbst, 1783))
Recorded by Buck from dry litter.

Clitostethus arcuatus (Rossi, 1794)
A single specimen of this rare little ladybird caught in the Malaise trap. It is associated with ivy. A *Red Data Book* category 1 (Endangered) species.

Stethorus punctillum Weise, 1891
One specimen of this tiny ladybird in the Malaise trap.

Exochomus quadripustulatus (Linnaeus, 1758)
The 'pine ladybird', several on tree trunks and on hawthorn blossom.

Tytthaspis (Micraspis) sedecimpunctata (Linnaeus, 1758)
The 16-spot ladybird was not as common as might be expected; a few examples taken in the sweep net.

* *Adalia bipunctata* (Linnaeus, 1758)
The generally common 2-spot ladybird turned up regularly in the Garden in pitfall traps, the Malaise trap, beating and sweeping. Buck records it as being fairly common when beating and sweeping.

Halyzia sedecimguttata (Linnaeus, 1758)
The 'orange ladybird'. Several hundred noted by Mark Lane overwintering on the underside of a bough.

Adalia decempunctata (Linnaeus, 1758)
The 10-spot ladybird was present in pitfall traps, the Malaise trap, general beating and sweeping. Represented by the type form and several confusing varieties. Surprisingly Buck doesn't record it.

* *Coccinella septempunctata* Linnaeus, 1758
The 7-spot ladybird. Common in pitfall traps, the Malaise trap, beating and sweeping. Often in numbers around the edge of The Lake in moss and grass. Buck took it by beating elm.

* *Propylea quattuordecimpunctata* (Linnaeus, 1758)
Several in the Malaise trap on numerous occasions. Buck took it by sweeping.

Psyllobora (=Thea) vigintiduopunctata (Linnaeus, 1758)
The 22-spot ladybird. Two specimens in the Malaise trap.

Endomychidae

Mycetaea hirta (Marsham, 1802)
A few specimens on two occasions at The Recycling Centre in vegetable refuse.

Lathridiidae

* *Aridius bifasciatus* (Reitter, 1877) (as *Lathridius bifasciatus*)
Several sieved from rotting fungus on The Mound. Four in the Malaise trap and a few in pitfall traps in various parts of the Garden, common at times in vegetable refuse at The Recycling Centre. Buck records it from compost.

* *Aridius nodifer* (Westwood, 1839) (as *Lathridius nodifer*)
Several in pitfall traps, the Malaise trap and occasionally by sweeping. Buck found it common in compost, humus soil, in grass in the cracks of large rocks and by sweeping.

* *Lathridius minutus* (Linnaeus, 1767) (as *Enicmus minutus*)
One specimen in rotting fungus on The Mound. Buck found it common in compost.

(*Enicmus histrio* Joy & Tomlin, 1910)
Recorded by Buck from compost.

Enicmus transversus (Olivier, 1910)
Several in the Malaise trap and occasionally by sieving moss.

* *Cortinicara gibbosa* (Herbst, 1793)
Several in a pitfall trap near The Waterfall and sometimes in the Malaise trap. Buck records it from vegetable litter and compost.

CISIDAE

(*Cis boleti* (Scopoli, 1763))

Recorded by Buck from under elm bark.

MYCETOPHAGIDAE

* *Typhaea stercorea* (Linnaeus, 1758)

Several on two occasions in the Malaise trap. Recorded by Buck from compost.

COLYDIIDAE

Myrmechixenus vaporariorum Guèrin-Méneville, 1843

One example of this uncommon beetle was sieved from vegetable refuse at The Recycling Centre. Recorded from West Kent to Yorkshire in the past and recently from just two vice-counties. A *Red Data Book* category 3 (Rare) species.

Langelandia anophthalma Aubé, 1843

One specimen collected by Richard Jones from soil around the base of a large poplar on The Island. Usually considered to be a rare southern insect, but recent work in Surrey by Prof. John Owen using underground pitfall traps discovered this small, blind subterranean beetle in numbers. The beetle has recently been found in Battersea Park by Richard Jones. A *Red Data Book* category 3 (Rare) species.

TENEBRIONIDAE

(*Blaps mucronata* Latreille, 1804)

Recorded by Buck from the potting shed where it was reputedly sometimes common. Not seen on the present survey or by the gardeners, but hopefully survives unnoticed due to its secretive, nocturnal lifestyle.

Cylindrinotus laevioctostriatus (Goeze, 1777)

One specimen under plane bark on The Island.

Lagria hirta (Linnaeus, 1858)

In pitfall traps and the Malaise trap.

Prionychus ater (Fabricius, 1775)

One specimen in the m.v. light trap.

SALPINGIDAE

(*Rhinosimus planirostris* (Fabricius, 1787))

Recorded by Buck from dry litter.

SCRAPTIIDAE

Anaspis humeralis (Fabricius, 1775)

Common on hawthorn blossom and occasionally by sweeping.

Anaspis lurida Stephens, 1832

A few on hawthorn blossom and in the Malaise trap.

Anaspis pulicaria Costa, A., 1854.

A few on hawthorn blossom and general sweeping.

* *Anaspis regimbarti* Schilsky, 1895

Common on hawthorn blossom and by sweeping. Buck took it in the sweep net.

MORDELLIDAE

Mordellistena neuwaldeggiana (Panzer, 1796)

Three specimens in the Malaise trap. Classed as *RDBK* but not uncommon in the London Area.

OEDEMERIDAE

Oedemera lurida (Marsham, 1802)

One in the Malaise trap.

To:
From: Martin Honey <mrh@nhm.ac.uk>
Subject:
Cc:
Bcc:
Attached:

Cerambycidae

Pseudovadonia livida (Fabricius, 1775)
formerly *Leptura livida* F.1775

A common grassland species, larvae in fairy ring mycelia.

One to light 26.vi.2003

ANTHICIDAE

* *Anthicus floralis* (Linnaeus, 1758)
Occasionally in the vegetable refuse at The Recycling Centre. Recorded by Buck from dry litter.

Omanadus formicarius (Goeze, 1777)
One specimen from vegetable litter at The Recycling Centre.

CERAMBYCIDAE

Grammoptera ruficornis (Fabricius, 1781)
A common insect in the Garden in the Malaise trap, on hawthorn blossom and by general sweeping. A recent arrival in the Garden as it was not found on the previous survey.

CHRYSOMELIDAE

Lilioceris lilii (Scopoli, 1763)
Recorded from *Lilium* sp. by Andrew Halstead and by talking to gardeners, common in the London Area.

Phaedon tumidulus (Germar, 1824)
Occasionally in pitfall traps.

Phaedon cochleariae (Fabricius, 1792)
Common by sweeping, adults and larvae.

Plagiodera versicolora (Laicharting, 1781)
Not uncommon in the Garden by sweeping.

Phyllodecta vulgatissima (Linnaeus, 1758)
Occasionally under plane bark.

(*Phyllodecta vitellinae* (Linnaeus, 1758))
Recorded by Buck from willow.

Galerucella calmariensis (Linnaeus, 1767)
On *Lythrum* sp. Andrew Halstead.

Galerucella lineola (Fabricius, 1781)
Several in the Malaise trap.

Phyllotreta atra (Fabricius, 1775)
Several in the Malaise trap.

Phyllotreta nigripes (Fabricius, 1775)
Common on several occasions in the Malaise trap.

Phyllotreta undulata Kutschera, 1860
A few specimens on one occasion in the Malaise trap.

Aphthona euphorbiae (Schrank, 1781)
One of the commonest species in the Garden, in pitfall traps, the Malaise trap, by general grubbing about in moss etc and beating and sweeping.

Longitarsus dorsalis (Fabricius, 1781)
Occurred regularly in the Garden in pitfall traps and in the Malaise trap. I have several records for the London Area, but never seen it elsewhere. It is associated with ragwort (*Senecio*) and classed as Nb.

Longitarsus flavicornis (Stephens, 1831)
Not uncommon in pitfall traps and the Malaise trap. Associated with ragwort.

Longitarsus parvulus (Paykull, 1799)
Not uncommon in pitfall traps, the Malaise trap, beating and sweeping. Once considered rare it has now become common in the south-east although its classification of Na. does not reflect this change.

(*Longitarsus rubiginosus* (Foudras, 1860))
Recorded by Buck from *Convolvulus* by The Lakeside.

Longitarsus succineus (Foudras, 1860)
Once in the Malaise trap, two specimens.

(*Longitarsus ferrugineus* (Foudras, 1860) (as *Longitarsus waterhousei*))
Swept from cultivated mint in The Yard Garden by Eric Gardner. This mint has long gone but Mark Lane took me to a promising patch on The Island which on that occasion produced no *Longitarsus*, but the beetle could still be in the Garden and it is hoped that it will turn up again in the near future. A *Red Data Book* category 1 (Endangered) species.

Crepidodera ferruginea (Scopoli, 1763)
One specimen on thistles, Richard Jones.

Crepidodera transversa (Marsham, 1802)
One specimen on thistles, Richard Jones.

(*Chalcoides plutus* (Lutreille, 1804))
Recorded by Buck from willow.

Chaetocnema hortensis (Fourcroy, 1785)
A common species in the Garden where it occurred in pitfall traps, the Malaise trap and in moss and grass around The Lake. Occasionally in the sweep net.

Chaetocnema concinna (Marsham, 1802)
One specimen in the Malaise trap.

Oulema melanopa (Linnaeus, 1758)
Occasionally in the Malaise trap and once by grubbing at the roots of grass on The Mound.

ATTELABIDAE

Rhynchites aequatus (Linnaeus, 1767)
Common on hawthorn blossom.

BRENTIDAE

Protapion trifolii (Linnaeus, 1768)
One specimen in the Malaise trap.

Protapion fulvipes (Geoffrey, 1785)
In moss and grass around The Lake.

Trichapion simile (Kirby, W., 1811)
Several specimens beaten from birch.

Ischnopterapion loti (Kirby, W., 1808)
One specimen in the Malaise trap.

CURCULIONIDAE

* *Otiorhynchus singularis* (Linnaeus, 1767)
Several in a pitfall trap near The Stoneyard. Recorded by Buck from a dung heap and at the m.v. light trap.

(*Otiorhynchus sulcatus* (Fabricius, 1775))
Recorded by Buck from specimens taken in the mercury vapour light trap.

Phyllobius pyri (Linnaeus, 1758)
Common on hawthorn blossom.

Barypeithes pellucidus (Boheman, 1834)
Two in a pitfall trap near The Waterfall. One in an underground pitfall trap and another in soil around the base of a large poplar on The Island.

Strophosoma melanogrammum (Forster, 1771)
Occasionally in the Malaise trap.

Liophloeus tessulatus (Mueller, 1776)
One in pitfall trap near The Fire Hole.

Sitona lineatus (Linnaeus, 1758)
Common on hawthorn blossom. A few in the Malaise trap and occasionally by grubbing at the roots of moss and grass around The Lake.

Sitona hispidulus (Fabricius, 1777)
One in a pitfall trap near The Tea House.

Magdalis armigera (Fourcroy, 1785)
One in the Malaise trap.

Dorytomus ictor (Herbst, 1795)
Several specimens swept by Richard Jones and John Owen at the base of a black poplar at the southern edge of The Lake. Recorded from several localities in London, mainly on large poplars planted in Parks. Classified Nb.

Ceutorhynchus assimilis (Paykull, 1792)
One specimen sweeping.

Ceutorhynchus erysimi (Fabricius, 1787)
Common on hawthorn blossom.

Parethelcus pollinarius (Forster, 1771)
Several swept from nettles near The Recycling Centre.

Rhinoncus castor (Fabricius, 1792)
Swept from *Polygonum amphibium* at the eastern edge of The Lake.

SCOLYTIDAE

Scolytus scolytus (Fabricius, 1775)
Several in the Malaise trap.

Scolytus multistriatus (Marsham, 1802)
Several in the Malaise trap.

Hylesinus oleiperda (Fabricius, 1792)
Several in the Malaise trap.

Acknowledgements

I would like to thank all those who contributed records, Mark Lane for his help with making arrangements for this survey (and some useful specimens), Norman Heal for his help checking the list, Colin Johnson for naming the Ptilidae and Paul Mabbott for information on the distribution of Carabidae in London.

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Smaller invertebrate orders in Buckingham Palace Garden

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Abstract

A survey of invertebrates was undertaken in Buckingham Palace Garden during the years 1995 to 1997 and comparisons of results made with a survey carried out in the early years of the 1960s. Records of several smaller orders of invertebrates recorded in the garden, yet inadequately represented by number of species to justify separate reporting, are listed and briefly discussed. The list comprises four isopod crustaceans, one species of Thysanura, two species of Ephemeroptera, two species of Odonata, two species of Orthoptera, one dictyopteran, one dermapteran, three Psocoptera, eleven Thysanoptera and five Parasitica. All are common species in the London area.

Introduction

During a survey of invertebrate taxa at Buckingham Palace Garden from 1995 to 1997 is was soon apparent that some invertebrate taxa were too poorly represented to warrant separate publications. Nevertheless, it was considered important that these data should be included in the final report, so that they were not lost altogether. This short paper combines the data for these less well-represented invertebrate orders under a single heading.

Most records emanate from the Malaise trap and species concerned were either identified by the present author or passed to other specialists. Some records, principally of woodlice, originate in the pitfall traps. Other data has been gleaned from the casual observations made by other entomologists undertaking their own studies in the Garden.

Little or no attempt is made to interpret these data, and the intention has been merely to set them on record. Information on these groups gained from the 1960s survey has been included so that the lists are complete.

An annotated list of smaller invertebrate orders recorded in Buckingham Palace Garden

Species found in the earlier survey, but not refound in the present survey, are enclosed in round brackets. Taxa recorded in both surveys are indicated by an asterisk in the left margin. Taxa with neither annotation are recorded for the first time by the 1990s survey.

CRUSTACEA
ISOPODA

Woodlice are a familiar site in most habitats that are not too dry. However, they are most frequent in places that are relatively infrequently disturbed and so are difficult to find in the well-manicured areas of the Garden. Four species, all widespread and common in London, were encountered in the present survey; two of these have been reported in the earlier work. At least one other common species may well be present but has not yet been encountered.

ONISCIDAE

* *Oniscus asellus* L., 1758

This common garden woodlouse was recorded sparingly under debris in shaded parts of the Garden throughout the survey. A few specimens were also noted in the Malaise trap sample for 20.x. – 20. xi. 1995.

PHILOSCIIDAE

Philoscia muscorum (Scopoli, 1763)

Several examples were noted in pitfall traps set amongst vegetation in the Firehole during 1997. The species was, apparently, not encountered during the 1960s survey.

PORCELLIONIDAE

Porcellio scaber Latreille, 1804

Numerically, this was the commonest species of woodlouse during the survey. It was present in many pitfall trap samples and in autumn Malaise trap samples in all three years.

TRICHONISCIDAE

* *Trichoniscus pusillus* Brandt, 1833

Recorded, but without any details, in the 1960s survey. During the 1990s survey it was encountered underneath a timber railway sleeper used as a retaining structure at the edge of a flowerbed near Harrison's Yard.

INSECTA
APTERYGOTA
THYSANURA
LEPISMATIDAE

Known as "bristle-tails", the Thysanura are represented in Britain by seven species in family Machilidae and two in Lepismatidae. The "silver-fish" is their only representative at Buckingham, Palace.

* *Lepisma saccharina* (L., 1758)

The common silverfish was recorded as a single specimen in "a domestic outhouse" in 1962. During the 1995 – 1997 survey, I saw one example near the sink in the Head Gardener's office during 1996.

DIPLURA

No specific searching for these invertebrates, known as the two-pronged bristle-tails, was undertaken during either the 1960s survey or during the present project, and no species are recorded. It is likely that several species are present.

PROTURA

No specific searching for these minute, soil-dwelling invertebrates was undertaken during either the 1960s survey or during the present project, and no species are recorded.

PTERYGOTA
EXOPTERYGOTA
EPHEMEROPTERA

The mayflies are very poorly represented in Buckingham Palace Garden, in keeping with the situation in the central London area generally.

CAENIDAE

(*Caenis horaria* (L., 1758))

Very abundant at light in July [1962] , and also in The Lake, during the 1960s survey. This is a species of larger lakes and rivers, especially where there are good deposits of silt. Its absence during the 1995 – 1997 survey is greatly surprising.

BAETIDAE

* *Cloeon dipterum* (L., 1761)

The 1960s survey notes "nymph in the lake". Several adults and sub-adults were noted in various Malaise trap samples during the 1990s survey at the rate of just one or two per sample. This is a common species in London, where it is known to breed in many garden ponds, apparently preferring waters that are heavily silted (personal observations).

ODONATA

Dragonflies and damselflies are, perhaps unsurprisingly, represented by very few species in central London. At Buckingham Palace garden, the group is represented by just two.

COENAGRIIDAE

* *Ischnura elegans* (van der Linden, 1820)

The earlier survey reports "one male and one female in June [1962] … has also been taken in the lake". The present survey records adults occasionally in the Malaise trap.

Enallagma cyathigerum (Charpentier, 1840)

An adult male was seen, and photographed, in the Garden by David Carter during June 1999. This is the only record available.

PLECOPTERA

Stoneflies do not appear to be represented at Buckingham Palace Garden in either of the two surveys.

ORTHOPTERA

Grasshoppers and crickets are very poorly represented in the central London area, and areas of land such as Buckingham Palace Garden are relatively isolated. Winged species may occur casually as vagrants, and this may be the nature of the Field Grasshopper (*Chorthippus brunneus*) noted in the 1960s but now, apparently, absent. However, the flightless Speckled Bush-cricket (*Leptophyes punctatissima*) must surely represent a long established colony?

ACRIDIDAE

(*Chorthippus brunneus* (Thunberg, 1815))

Several were noted in long grass by The Lake "in the autumn" during the earlier survey.

TETTIGONIIDAE

* *Leptophyes punctatissima* (Bosc, 1792)

A single female of this wingless species was encountered at the Garden by John Bradley in September 1962; no location within the Garden is given. During the present survey, single adults, both females, were noted in two separate autumn Malaise trap samples.

DICTYOPTERA

Native British cockroaches are more or less confined to our southern shores and the group is represented in London only by those species that live in association with man. These are almost all tropical species that have been artificially introduced to Britain and have adapted to life in warm buildings. They are omnivorous and their presence does not automatically indicate that the premises they occupy are at all dirty. Only one species is recorded at Buckingham Palace, and this has apparently been eradicated.

BLATTELLIDAE

(*Blattella germanica* (L., 1767))

The report of the 1960s survey discretely noted "a few indoors"; none were encountered in the present survey. Although the recent survey was confined to the Garden and did not include heated indoor areas, modern hygiene standards render it most unlikely that cockroaches are to be found inside Buckingham Palace now.

DERMAPTERA

Two species of earwig are present in the built up areas of London, though only the one here reported is at all common.

FORFICULIDAE

* *Forficula auricularia* L., 1758

Recorded as common and found on nearly every visit during the 1960s survey, the situation remains unchanged in the 1995 – 1997 period.

PSOCOPTERA

Also known as "booklice" or "barklice", the Psocoptera are a much-neglected group of insects. No specific searching for them was carried out in the Garden, though three species were noted, one in the present survey and two in the 1960s study.

PSOCOIDEA

PSOCIDAE

(*Amphigerontia bifasciata* (Latreille, in Coquebert, 1799))
One was noted at light in July [1962] in the earlier survey.

PHILOTARSIDAE

(*Elipsocus westwoodi* McLachlan, 1867)
The earlier survey records one male and two females "on bushes" in September [1962].

ECTOPSOCIDAE

Ectopsocus briggsi McLachlan, 1899
Recorded in the Malaise trap on many dates and apparently common here. The surprise is that no other species appear to be represented in the samples.

MALLOPHAGA

No "biting lice" were recorded in either survey, though no specific surveys for these avian ectoparasites were undertaken.

ANOPLURA

No anoplurans were recorded in either survey. Known as "sucking lice", they are ectoparasitic on mammals and no specific survey of them was undertaken.

THYSANOPTERA

Eleven species of thrips were recorded in the earlier survey. I list them here for completeness, without comment, and readers are referred to the original paper for details (Richards 1964). No thrips were listed in the 1995 – 1997 survey.

THRIPIDAE

Chirothrips manicatus Hal.
Chirothrips hamatus Tryb.
Limothrips dentcornis Hal.
Limothrips cerealium Hal.
Aptinothrips rufus (Gmal.)
Odontothrips meridionalis Pr.
Taeniothrips atratus (Hal.)
Taeniothrips vulgatissimus (Hal.)
Thrips fuscipennis Hal.
Thrips major Uzel
Frankliniella intonsa (Tryb.)

ENDOPTERYGOTA

SIPHONAPTERA

No fleas appear to have been recorded in either survey.

HYMENOPTERA

PARASITICA

CYNIPOIDEA

CYNIPIDAE

Andricus kollari (Hartig, 1843)
"marble galls" noted on oak twigs.

Andricus ostreus (Hartig, 1840)
Characteristic galls noted on the midrib of oak leaves

Andricus quercuscalicis (Burgsdorf)
The distinctive "knopper gall"was noted on acorns in the Garden during 1995.

Neuroterus quercusbaccarum (L., 1758)
Leaf galls noted on oak leaves.

CHALCIDOIDEA

APHELINIDAE

Encarsia formosa Gahan, 1924
Identified by Mike Fitton from Malaise trap samples.

STREPSIPTERA

No species of strepsipteran were recorded in either survey. Also known as stylopids, these small insects are parasitic on other insects, notably bees (Aculeata, Apoidea) and plant hoppers (Homoptera).

Acknowledgements

I am grateful to Stephen Brooks and Judith Marshall, both in the Department of Entomology at the Natural History Museum and to Peter Harvey, Essex Field Club, for some identifications of specimens.

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PLATE M. Buckingham Palace Garden, London. View across The Lake, July 1998.

Photographed © by Mark Lane

Non-lichenised fungi in Buckingham Palace Garden*

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Abstract

Non-lichenised fungi were studied at Buckingham Palace Garden between July 1997 and August 1998. A total of 630 species is recorded of which two are new to science and have been described elsewhere. An earlier survey from 1960 to 1963 recorded only 53 species and of these twelve are not recorded in the 1997 to 1998 results. The list of recorded species is presented and discussed.

Recording methods

The fungal records are based largely on 36 visits by the present author from July 1997 to August 1998, once a week during much of the time, once a fortnight when conditions were less productive. These are supplemented by many records from Peter Holland, who has recorded mainly microfungi and myxomycetes, a few from David Hawksworth made while recording lichens, and a few from single visits by Bruce Ing and Brian Spooner.

Many fungi are too small to have much chance of being observed directly in the field. To ensure that some at least of these were recorded, suitable substrates were often collected ‘on spec’ and examined at leisure under a dissecting microscope. Substrates well known to support a wide range of fungal species were then ‘cultured’, i.e. kept in moist conditions in normal light at room temperature for a number of days or weeks, and examined at intervals. This is a standard technique for recording myxomycetes on bark or for observing the succession of fungi that appear on dung, but it is also effective in revealing fungi on many other substrates. It was used on hazel nuts, acorn cups, beech cupules etc. and on fallen leaves. Leaves of *Laurus nobilis* and *Quercus ilex* are known to be rich sources of hyphomycete species in particular (Kirk 1981), and duly proved very productive. Several groups of fungi requiring specialised identification techniques were not studied at all, notably fungi parasitic on insects and most hyaline hyphomycetes.

Collections, when in good condition, of all the less common or more critical species have been deposited in Kew Herbarium (K), and in a few instances also in the herbarium of CABI Biosciencies (IMI).

Numbers of Species

A total of 630 species has been recorded, including at least two new to science. Several others have not been matched at Kew and have been filed as unnamed species pending revision of the genera concerned.

That so many have been recorded reflects the personal good fortune of the author in having time to devote to the project and in being given generous access to the garden. Another crucial factor has been the valuable help supplied by many experts. Even so, the present total could surely be at least doubled given more years of recording and a rather improbable measure of further expert back-up.

Around 12,000 species have been recorded in Britain and more remain to be distinguished. Given the range of habitats in the garden and the mobility of most fungal spores, the current figure of not much over 5 per cent of known British species is evidently still low. The ease with which further species continue to be found on each successive visit reinforces this conclusion. But just how far the total could rise given more years of recording must remain a matter for idle speculation. No site anywhere in the world has been anything like exhaustively monitored for fungi. There are, therefore, no statistical models by which to extrapolate from limited recording to an estimate of the true total of species present at any given time.

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* Unfortunately, the author has been unable to prepare a final manuscript of his paper of the non-lichenised fungi at Buckingham Palace Garden. It has been necessary, therefore, in order to achieve completeness in the overall report, to edit and print Dr Henrici’s draft paper, which he prepared at the end of 1997. This paper has not, therefore, been subjected to peer-review.

The Garden as a Site for Fungi

The garden is far from exclusively formal. The formal lawns and beds blend into other areas such as parts of The Mound and the Island which are left semi-wild. In places the grass is allowed to grow long and is cut once a year almost as a hay meadow. The Lake has a long perimeter of marsh plants under a similar regime. Most native British tree species are present in small numbers, together with innumerable exotics. The happy result is a far richer diversity of habitats than might be imagined and a corresponding richness in the fungal population.

For the last eight years the Recycling Centre has been in operation, the compost applied to the beds being largely derived from the Garden itself, supplemented only by horse dung and stable straw from the adjacent Royal Mews. Fungi that enjoy this regime sometimes build up in large numbers on mulched beds. Fungicides are sparingly applied, though war is waged on Honey Fungus (*Armillaria mellea*). New plants are constantly being imported into the garden, some unintentionally carrying further fungi with them.

To counterbalance the above pluses there is one large minus for fungi, the shortage of rotten wood or woodland litter. Fallen trunks and branches are speedily chopped up and removed. Records of lignicolous fungi have had to come from close monitoring of the few rotting tree stumps in the garden. The main sources of leaf litter are *Ilex, Rhododendron, Camellia*, and overwhelmingly in late autumn the hundred or so mature *Platanus*. But this is all promptly swept up and recycled, so the floor of the shadier beds tends to be rather unproductive mycologically.

The garden is fairly acid, so strictly calcicole species are in general absent (but see below for some unexpected *Lepiota* species). It is also fairly dry, but gets well watered in parts, producing unexpected fungal flushes at otherwise unproductive times. Recent record warm years combined with the additional warming from its central London situation make it a prime site to expect new British records of southern thermophyllic species, but none have so far appeared.

The Survey in Perspective

In the 1960-63 Palace survey the fungi were scarcely recorded at all. The list contained only 53 species, some named only to genus. Twelve of these have not been seen again, three agarics, three ascomycetes and six mitosporic fungi, discussed in the appropriate sections below. There will undoubtedly have been changes in the fungal population since 1963, reflecting changes in the garden as a whole. Certain hosts are gone, such as the mature elms, and tulips which were formerly planted out by the thousand. Many more have come, notably a wider range of conifers. There have also been changes in the country at large. A few 'worldwide weed' fungi that were unknown or scarcely known here in 1963 have become common in Britain.

There is a lack of comparable studies from which to assess the importance of the Garden as a fungal habitat. Little has been done in the London parks apart from occasional autumn forays recording the larger toadstools. A partial exception is Holland Park, where the present author recorded fungi intermittently over the period 1980 to 1996 while living in the area. His unpublished list, including records by other observers, is held by the Holland Park Ecology Officer. It included 199 'Agarics & Boletes', 11 Gasteromycetes and 69 'Other Basidiomycetes', figures very comparable to those currently recorded from the Palace Garden. However, these totals were only reached over sixteen years of recording. Too few records were made in other fungal groups to provide comparative data.

Comparison may also be made with the Royal Botanic Garden, Kew; more rural, nearly eight times the size, with an even wider range of host plants, and a century or so of fungal records. Massee (1906) recorded 1300 species. A revised list of just the agarics and boleti was prepared by Pegler (1966) who listed 570 species, though considering many of the older records doubtful. The doubtfuls are likely to have been at least offset by other good records in the last thirty years, giving an approximate factor of three between Kew and the Palace in the numbers of agarics and boletes reported. This may be due in about equal measure to greater habitat diversity and greater recording effort at Kew.

Another London site the author has surveyed in detail is Perivale Wood, Ealing, an oak/bluebell wood with adjacent unimproved pasture. There some 940 species have been recorded over ten years including 290 agarics and boleti. It is a site of comparable size, containing far fewer higher plant species, but 'wild' and well supplied with dead wood and litter. It is now getting difficult to record more species there in any quantity, whereas at the Palace Garden it is still merely a matter of spending more time.

As a final point of comparison Esher Common, Surrey is very much larger with a more diverse range of habitats. It is one of the two most intensively surveyed areas in the country for fungi and has a list built up over many years currently standing at 2,800 species (Brian Spooner, unpublished ms.).

All these pointers suggest the Palace list still has a long way to go. Ideally every potential fungal substrate needs examining at every time of year over several years. That is the easy bit. It then needs experts to offer verdicts on the fungi so found, many of which in the more obscure groups are likely to be undescribed. But it is already clear from the current survey that the Palace Garden supplies an undisturbed haven for many fungi that are rarely recorded in the London area.

Notes on the various groups of fungi

The fungi are here considered to comprise (in a widely used formulation) 'all organisms studied by mycologists'. They are a very diverse assemblage, currently occupying all of one Kingdom and small parts of two others (Dictionary of the Fungi, 1995). They are treated below and in the species lists in 10 numbered groups related as follows:

- Kingdom Fungi
  - Phylum Basidiomycota
    - Class Basidiomycetes
      - c.20 Orders, here treated in three groups:
      - 1. Agarics & Boletes
      - 2. Gasteromycetes
      - 3. Other Basidiomycetes (Aphyllophorales + Heterobasidiomycetes)
    - Class Teliomycetes: 4. Rusts
    - Class Ustomycetes: 5. Smuts
  - Phylum Ascomycota
    - No Classes currently defined, here treated in three groups:
      - 6. Powdery Mildews
      - - Lichenised Ascomycetes (not included in the present work)
      - 7. All Other Ascomycetes ('Discomycetes' + 'Pyrenomycetes')
  - Phylum Zygomycota:
      - 8. Zygomycetes
  - Mitosporic Fungi (= Fungi Imperfecti)
      - 9. Coelomycetes + Hyphomycetes
- Kingdom Chromista p.p.
  - Phylum Oomycota:
      - 10. Oomycetes
- Kingdom Protozoa p.p.
  - Phylum Myxomycota: Myxomycetes (not included in the present work)

1. Agarics & Boletes (200 species)

Several habitats call for discussion:

The famous lawns are not species-rich, but are far from devoid of fungi. The Main Lawn is largely free of fairy rings, but these and their causal agent *Marasmius oreades* are plentiful over much of the remaining grass, as is the 'hay-cap' *Panaeolus foenisecii* throughout the summer. In late autumn, in common with other old and not over-fertilised lawns in the London area, very large troops of three *Mycena* species can occur in a favourable year, *M. aetites, M. olivaceomarginata* and *M. flavoalba*, together with other lawn species such as *Hemimycena mairei, Galerina laevis* and *Tubaria conspersa.*

Many beds periodically receive a heavy mulch via the recycling system. This regime seems to favour above all the wood blewit, *Lepista nuda*, present in enormous numbers in all the shadier beds in late autumn but recorded in literally every month of the year. Fructifications were very variable in shape, size and colour, leaving the demarcation from *L. sordida* far from clear. *Coprinus flocculosus, Conocybe rickenii, C. siennophyla* and *Panacolus subbalteatus* are other species regularly occurring in this habitat. A few beds have the spectacular *Stropharia aurantiaca* that has become common in south-east England in recent years with the spread of bark mulches. But pride of place must go to *Panaeolus atrobalteatus*, new to science (see Pegler, 1998), which appeared in spectacular numbers (around 3,000?) in just one bed under holly in November 1997, where it was initially observed by Mark Lane. This was at first thought to be a dark grey colour variant of *P. subbalteatus*, but was found to have much smaller spores and to fit nothing in the world literature on this genus. The mystery is where it came from and why it fruited so prolifically in just one bed when others shared the same aspect and had received the same composting regime. It is too conspicuous a species to have been overlooked until now if it had long been present in western Europe. Further appearances are awaited with interest.

The lakeside has produced a number of interesting and little recorded species of *Inocybe* and *Cortinarius mycorrhizal* with *Populus* or *Salix*. In particular a puzzling *Inocybe* in the *I. dulcamara* group is common here. If it has been previously recorded in Britain it is likely to have been as *I. perbrevis*, but the correct interpretation of this name is open to doubt.

In damp summers the bases of long grass clumps (especially *Holcus*) provide an interesting habitat that has evidently been insufficiently studied in Britain. *Melanotus phillipsii* is the most characteristic species of this community and was found in abundance. More interesting was *Entoloma albotomentosum*, minute, initially white but pink when the spores ripen, growing right at the base of grass clumps where it will never be found without deliberate exploration. Its habits are so retiring that it was only discovered and described as new to science from Austria in 1989. A record on 30 June 1998 was the second in Britain, the first being nine months earlier at Kindrogan, Perthshire. However once the habitat was known and other mycologists alerted it was promptly discovered to be widespread in Kew Gardens and was also found without difficulty at Runnymede and in Windsor Great Park. It seems likely to be common over much of Britain, a good example of how much is still to be learnt about Britain's fungi.

Several beds briefly displayed a surprising array of notably calcicole species of *Lepiotaceae*, eventually traced to an exception to the general recycling regime. Application of a proprietary compost to certain beds, billed as a renewable resource derived from underground Pennine aquifers, produced a remarkable flush of uncommon species, including *Lepiota cortinarius, L.fuscovinacea, L. hetieri* and *L. setulosa.* These are not expected to be seen again as the soil is, in general, too acid.

Surprisingly a small area of grassy slope just north of the lake produced a few of the characteristic fungi of unimproved grasslands, with two *Hygrocybe* species, a *Dermoloma* and a *Clavaria* all found nowhere else in the Garden. It would be nice to think that these represent survivors of the marshy meadow community that must have existed before the Palace was built or the Garden enclosed.

On the debit side, the main mycorrhizal genera are poorly represented. *Boletales, Russulales* and *Amanita* are represented by few species in small numbers. For instance the following, which are among the most commonly recorded of all British fungi, have not been found: *Boletus badius, Russula ochroleuca, Lactarius quietus, Amanita fulva* and *A.citrina.* Among other very common woodland fungi *Collybia confluens, C. maculata* and *C. peronata* also appear to be absent, though *C. butyracea* and *C. dryophila* are both quite plentiful on The Mound. Maybe the others cannot stand the litter clearing regime. Even *Mycena speirea* has not been seen.

Among many genera to cause identification problems the most awkward has probably been *Clitocybe.* Quite a few species are present at various times of year and in various habitats, but seldom keying out with conviction among the conflicting treatments in the literature. *Agaricus* and *Hebeloma* leave similar feelings of uncertainty, though there is no doubt that among several *Agaricus* species present the commonest are *A. xanthoderma* and *A. bisporus.*

Three species on the 1963 list have not been re-recorded. The most notable is the well known 'Magic Mushroom' *Psilocybe semilanceolata*, recorded on the lawn as recently as 1979, but not since. The other two are *Macrolepiota rhacodes*, the 'Wood Parasol', common in many Inner London wooded areas and rather surprisingly not found, and *Cystoderma amianthinum* whose presence in the earlier survey was somewhat unexpected.

2. Gasteromycetes (11 species)

A traditional grouping, but with affinities in various directions and no longer considered to form a single class of fungi.

The giant puffball, *Calvatia gigantea*, already recorded in 1963, occurs in numbers in some beds and especially the Firehole. One of the bird's nest fungi, *Cyathus olla*, flourishes with the composting regime and often appears on beds in large numbers, but the others seem absent. Another notable absentee is the stinkhorn, *Phallus impudicus.* One unusual species was found, a small (1.5cm) but far from edible 'truffle', *Melanogaster ambiguus*, the so-called 'stinking slime truffle', sometimes found in domestic timber when 'a single specimen in a room is so strong as to make it scarcely habitable' (Berkeley, quoted in Pegler et al. 1993). This one was at the soil surface on The Mound and did not smell too bad when collected but later developed a powerful and complex aroma of rotting fruit or vegetables.

3. Other Basidiomycetes (101 species)

Here are included both the 'Aphyllophorales' (club fungi, polypores, corticioids etc.) and the 'Heterobasidiomycetes' (jelly fungi). Neither of these groups is now recognised as a natural unit. Species on the Palace Garden list are currently distributed among some 20 orders.

These are largely lignicolous fungi so would not be expected to be particularly well represented. But although there is not much rotten wood present, what is there is fairly varied, so a fair range of records have nevertheless been made. Two rather uncommon species are worthy of note: *Auriculariopsis ampla* superficially resembles a small pale *Auricularia*; it grew on *Populus* twigs by The Lake and is not known from more than around ten sites in Britain. *Perenniporia fraxinea* as its name suggests is a perennial polypore, but is not confined to *Fraxinus.* It has evidently been growing for some years at the base of one of the Plane trees. It is already known in this habitat in the London area, but is not common. It causes a white root and butt rot, but the tree is likely to survive for many years yet.

Corticioid fungi are not yet well recorded in Britain, good literature having only recently become available. So inevitably a few of the finds in this group give the impression of being rarities, though this may not in fact be the case. *Cristinia coprophila* however is probably genuinely rare. It was described from a manured bed in Kew in 1916 and had only been found in Britain once since (Perivale Wood, Middlesex 1994) before being recorded here in July 1997 under a sheet of chipboard. It is also scarcely known outside Britain. *Ceratobasidium calosporum* was previously known only from the type collection from Iowa until recorded in Britain by Peter Roberts in 1991. He has since recorded it from several sites in southern England, but it is still unknown elsewhere in Europe. The Palace collection was on the bark of a fallen *Sorbus*, probably *S. aucuparia.*

Among notable absentees it may be significant that no *Typhula* species have been found on leaf litter.

4. **Rusts** (24 species)

These are probably somewhat under-recorded in comparison with most groups. They need a collector with a good knowledge of where and when to expect them. Nothing very rare or remarkable has been found except that the survey coincided with the rapid spread in England of the 'new' rust on daisies, *Puccinia distincta.* This rust is a native of Australia, which from being unknown in Britain, spread during 1997 and 1998 to being common on *Bellis perennis* throughout most of England, its aecidia producing conspicuous yellow patches on the leaves (see Weber et al. 1998). It was first recorded at the Palace in September 1997 a few weeks after it had already become well known at Kew, and is now widespread on the lawns.

5. **Smuts** (2 species)

Not a large group, but 46 species have been recorded from south-east England (Dennis, 1995), so they appear to be somewhat under-recorded. Several potential hosts are present, but the two that can normally be almost guaranteed to carry smuts (*Arrhenatherum elatium* and *Silene dioica*) are each only present in small numbers.

6. **Powdery Mildews** (45 species)

These comprise just one of 14 orders of Ascomycota recorded from the Garden, but they are so distinct from the rest and so well represented that they are treated separately. As gardeners will know, mildews are a fact of life, and the richer the garden, the richer will be the mildews. With its wide range of labelled plants the Palace provides an ideal place to make interesting mildew records. Ing (1990) lists 99 species as British, most confined to a particular genus or family of plants. Nearly half of these have been recorded, a far higher proportion of the British total than in any other group of fungi. And undoubtedly more remain to be found, as suitable hosts are present for many of the rest.

None of the mildews found are new to Britain, but several, indicated in the list, occurred on new hosts (for Britain). Most of these are unremarkable, being merely found on garden relatives of their normal hosts (eg. the common mildew on *Ranunculus* spp. was found also on *Cimicifuga*). But the common Cat's-ear (*Hypochaeris radicata*) seems not to have been noted before in Britain among the many *Asteraceae* that are hosts to *Erysiphe cichoracearum.* The mildew on the London Plane, *Microsphaera platani*, is a recent arrival in Britain, after spreading steadily westwards across Europe. It is not expected to do serious damage to the trees. The first British record was in 1990 by B. Ing, who is also responsible for the Palace record.

The traditional division into 'Discomycetes' and 'Pyrenomycetes' is not followed in the species list, as neither are natural units. All are merely Ascomycetes, within which 14 non-lichenised orders are represented in the Garden.

Discomycetes records have been rather few and the group is remarkable chiefly for absences. The annual cut back of long vegetation round the lake removes the dead herbaceous stems that might otherwise be host to many small species. The lack of rotting wood has meant that several very common species including *Ascocoryne sarcoides, Bisporella citrina, Scutellinia scutellata* and even *Lachnum virgineum* have all gone unrecorded. However a small red-brown *Peziza* species found at the base of grass clumps in June 1998 is certainly new to Britain and possibly undescribed according to B. M. Spooner; more research is needed to establish its status.

Several pyrenomycetes normally considered rare have been found, though as these are all fairly small and inconspicuous they may merely be under-recorded elsewhere. *Kernia nitida, Podospora perplexans* and *Zopfiella erostrata* on horse dung are rarely recorded. *Cephalotheca sulfurea* is distinctive and probably genuinely rare. It has occurred throughout the year under some pieces of worked conifer wood of unknown origin. *Trematosphaeria tripartita*, on a fallen *Sorbus* branch, is only the second British collection of a recently described species; the first, from Skye, was also on *Sorbus*.

The most interesting pyrenomycetes have been two distinctive species of *Melanospora. M. longisetosa* was described in 1982 from a single collection on an elm stump at Kew and known since only from *Laurus* leaves in Dorset. At the Palace it occurs on a wide range of different hosts including *Laurus*, but also *Araucaria* (Monkey Puzzle) leaves, on which it was particularly abundant. Possibly these are its natural home as it was subsequently found again on *Araucaria* leaves from Kew, in each case only after keeping them damp for two weeks or more. The second species also occurred on fallen leaves of *Laurus*, but additionally on *Camellia* and *Rhododendron*, and appears to be undescribed.

The absence of rotting wood is reflected in the dearth of *Hypoxylon* species. Only *H. rubiginosum* has been recorded. There are several beech trees so *Diatrype disciformis* is probably not really absent, but their litter is so efficiently swept up that the fungus has not yet been recorded.

Three species from the 1963 survey have not recurred. Two of these, *Mitrophora semilibera* and *Verpa conica*, are relatives of the morels, not very common, more usually on calcareous soils, and altogether rather unexpected when D. A. Reid found one of each on 1 May 1963. There is also a collection at Kew of an actual morel, *Morchella conica* (which would now be called *M. elata*) collected by Fred Nutbeam (then Head Gardener) in 1967 'amongst moss on top of old wall, B. P .Gate', a location that cannot now be traced. These have all been searched for, but it is no great surprise they have not been found again. The third species from 1963 is the inconspicuous *Nectria aguifolii*, probably still present as its host *Ilex* is abundant.

8. Zygomycetes (6 species)

Around 100 species are known in south-east England (Dennis, 1995), mostly moulds in the order *Mucorales*. But no serious effort has been made to record this group. Only chance finds have been made of a few of the more distinctive species. The *Zygomycota* also include a second rather obscure class, the *Trichomycetes*. These are parasites or commensals in the gut of arthropods, e.g. in the larvae of aquatic *Diptera* and have, not surprisingly, gone unrecorded in this survey.

9. Coelomycetes & Hyphomycetes (132 species)

These are often referred to as 'Fungi Imperfecti' and more recently as Mitosporic Fungi. They are asexual, some having a known sexual state in the Ascomycetes, others probably having one that has yet to be identified, yet others probably without the capacity to form a sexual state and reproducing only by conidia. Coelomycetes form their conidia within a cavity surrounded by fungal tissue, hyphomycetes form them in the open, but there are intermediates and the significance of this distinction has been over-emphasised in the past.

Most coelomycetes are rather featureless and difficult to identify, just as larvae are in general less readily identifiable than perfect insects. Many have not been attempted. Two recorded as new to Britain in the 1963 survey have not been refound, nor has one on elm twigs. Three of the 1963 hyphomycetes have not been refound either. Two are probably still present, but the third, *Botrytis tulipae* = Tulip Fire Fungus, is likely to have departed from the garden together with the major plantings of tulips. Many hyaline hyphomycetes, including well-known genera such as *Penicillium, Fusarium, Verticillium* etc. in general need to be grown in pure culture for a reliable identification. This is outside the scope of the present survey.

The dematiaceous (= non-hyaline) hyphomycetes are in general easier. Quite a number have been recorded, often by damping suitable substrates and keeping them under observation. Several species previously reported as specific to the leaves of *Quercus ilex* or *Laurus nobilis* were also found on other tough fallen leaves such as those of *Rhododendron* and *Camellia. Sporidesmium dennisii*, common here on *Quercus ilex* leaves on The Mound, was previously known only from its type site at Wakehurst Place (East Sussex) and from Esher Common (Surrey). Several species await determination, some of which may be undescribed. This is a group in which it is much easier to find a new species than it is to find an expert with the time to verify that it is new and to describe and publish it.

10. Oomycetes (2 species)

These are no more fungi than are the myxomycetes. They are now placed in a different kingdom, *Chromista*, together with a variety of obscure mainly unicellular organisms, but are listed here on the grounds of tradition and convenience. The best known Oomycetes are the *Peronosporales*. These include the downy mildews and also the 'white' or 'blister' rusts, plant pathogens in the genus *Albugo*, two of which have been recorded. Downy mildews must occur in the garden, but they are very inconspicuous and seem to need a trained eye to detect them. Other Oomycetes likely to occur include members of the genus *Pythium* causing damping off in seedlings and a variety of root rots. Some of the *Saprolegniales* or 'water moulds' could also be present infecting fish in the lake.

A annotated list of the non-lichenised fungi recorded in Buckingham Palace Garden

Sources	(usually only of first record)
1963	recorded on the 1963 published list
BI	recorded by Bruce Ing while collecting bark myxomycetes 16.1.97
DIH	recorded by David Hawksworth
PCH	recorded by Peter Holland
+	(suffixed to any of the above) means seen personally, 7.7.97 onwards
m.n	day.month (in 1997) of first personal record

A letter 'K' denotes that material (not necessarily of the first collection) has been deposited in the Kew herbarium or will eventually be deposited there. Similarly IMI denotes material at the International Mycological Institute.

Two further phyla studied by mycologists, Qomycota and Myxomycota, are also covered here, though no longer considered part of the kingdom Fungi.

BASIDIOMYCOTA

AGARICALES (in conventional order of families)

Hygrophoraceae

Hygrocybe conica	PCH+ as *H. nigrescens*
virginea	24.11 K

Tricholomataceae

Armillaria lutea s.l.	20.10 = *A. mellea* of 1963 list p.p.
Armillaria mellea s.s.	6.10 = *A. mellea* of 1963 list p.p.
Baeospora myosura	10.11 on *Cedrus deodarus* K
Calocybe carnea	7.7
Calyptella capula	PCH+
Clitocybe agrestis	7.7 = *C. angustissima* = *C. graminicola* K
cf. *amarescens*	24.11 ?= =*C. nitrophila* K
dicolor	24.11
nebularis	PCH as *lepista* n.
rivulosa	20.10 K
vibecina	17.11
Collybia cirrhata	20.10
dryophila	4.8
erythropus	20.10
obscura s.auct	24.11 K
Dermolorna josserandii v. *phaeopodium*	24.11 = *D. phaeopodium* Orton 1980 K
Flammulina velutipes	24.11
Hemimycena mairei	15.9 PCH det. AH K
Laccaria laccata	PCH+
Lepista nuda	1963+
saeva	10.11 K
sordida	17.11 K
Lyophyllum decastes	21.7
Marasmiellus ramealis	7.7 (needs confirmation, might have been next)
vaillantii	20.8 = *Marasmius calopus*
Marasmius curryi	4.8 = *M. graminum*
oreades	PCH+
rotula	PCH+
Melanoleuca arcuata	10.11 = *M. melaleuca* s.auct. p.p K
polioleuca	20.10 = *M. melaleuca* s. auct. p.p. K
strictipes	9.9 K
Mycena adscendens	17.11
aetites	20.10 K
clavularis	DLH det. E.E. Emmett
filopes	17.11 K
flavescens	20.10 K
flavoalba	PCH+
galopus v. nigra	17.11 K
leptocephala	20.10 K
galericulata	PCH+
olivaceomarginata	20.10 K
polyadelpha	17.11
sanguinolenta	28.11
stylobates	4.8
vitilis	10.11
Resupinatus applicatus	28.11 inc. *R. trichotis* K
Rickenella fibula	4.8
swartzii	24.11
Tricholoma scalpturatum	10.11 = *T. argyraceum* s.auct.

Entolomataceae

Clitopilus hobsonii	20.10
Clitopilus prunulus	PCH+
Entoloma farinolens	9.9 cf this (one old specmen only)
hebes	27.10 K
sericeum	17.11 K

Pluteaceae

Pluteus cervinus	1963+
podospileus	7.7 K
Volvariella speciosa	1963+

Amanitaceae

Amanita muscaria	PCH+
rubescens	7.7
spissa	7.7 = *A. excelsa*

Agaricaceae

Agaricus bisporus	1963+
Agaricus campestris	PCH+
cf. *comtulus*	20.10 K
cf. *niveolutescens*	6.10
silvaticus	7.7
variegans	20.10 K
xanthoderma	7.7
Cystoderma amianthinum	1963
Lepiota cortinarius	20.10 K
cristata	PCH+
+ cf. var. *felinoides*	27.10 (not worth separating?) K
fuscovinacea	20.10 K
hetieri	20.10 K
josserandii	15.8 ? = *L. subincarnata* K
cf. *kuehneri*	17.11 K
Leucoagaricus cinerascens	27.10 K
leucothites	PCH+
subcretaceus	17.11 K
sp. indet.	6.10 K
Leucocoprinus birnbaumii	4.8 in Greenhouse No. 1
Macrolepiota rhacodes	1963
Melanophyllum haematospermum	20.10 = *M. echinatum* K

Coprinaceae

Coprinus atramentarius	1963
cinereus	27.10 K
disseminatus	7.7
flocculosus	4.8 K
friesii	4.8
cf. *heterosetulosus*	15.8 K
leiocephalus	15.8
macrocephalus	6.10 K
marculentus	15.8 = *C. hexagonosporus* K
micaceus	PCH+
patouillardii	27.8 K
plicatilis	1963+
Lacrymaria velutina	7.7
Psathyrella atrolaminata	17.11 K
microrrhiza	17.11 K
gracilis	19.9 K
multipedata	PCH
piluliformis	24.11 = *Ps. hydrophila* K

Bolbitiaceae

Bolbitius vitellinus	PCH
Conocybe arrhenii	28.11 K
lactea	15.8 K

cf. *kuehneriana*	15.8
rickenii	19.9 K
siennophylla	7.7 K
sordida	20.10 K
vestita	10.11 K

Strophariaceae

Hypholoma fasciculare	PCH+
Melanotus phillipsii	4.8 (inc. rec. on bluebell stem) K
Panaeolus foenisecii	7.7
subbalteatus	20.8 (inc. rec. as *P.* cf. *fimicola* 7.7) K
sp. nov. ??	*24.11 near P. subbalteatus,* spores much smaller
Pholiota conissans	20.10 K
cf. *limonella*	24.11 = *Ph. adiposa* s.auct. K.
squarrosa	PCH+
Psilocybe semilanceata	1963 still present in 1979 (Mark Lane)
Stropharia aurantiaca	10.11
caerulea	20.10 = *S. cyanea*
inuncta	20.10 K
semiglobata	PCH

Crepidotaceae

Tubaria autochthona	20.10
conspersa	20.10 K
furfuracea	1963+
cf. *pallidospora*	6.10K

Cortinariaceae

Cortinarius cohabitans	10.11 = *c. saturninus* v. *bresadolae* det. G. Kibby K
hemitrichus	10.11
parvannulatus	17.7 = *C. cedriolens,* det. G. Kibby K
sertipes	6.10 K
cf. *violilamellatus*	10.11 det. G. Kibby K
Galerina clavata	20.10 K
hypnorum	PCH+
laevis	20.10 = *G. graminea* K
Gymnopilus penetrans	24.11 K
Hebeloma bruchetii	10.11 = *H. repandum* s. Bruchet det. Kibby K
crustuliniforme	PCH+
gigaspermum	20.10 K
leucosarx	10.11 det. G. Kibby K
mesophaeum	10.11 K
pusillum	19.9 K
vaccinum	20.10 K
Inocybe curvipes	7.7 = *I. lanuginella* K
cf. *flocculosa*	9.9 one sepcimen only
geophylla	7.7
malenconii	7.7 near *I. dulcamara* – new to Britain? K
pusio	15.9 PCH det. AH K
squamata	20.10 K

BOLETALES

Boletus edulis	PCH
Chalciporus piperatus	10.11
Paxillus involutus	7.7
Xerocomus chrysenteron	PCH+ as *Boletis*

RUSSULALES

Lactarius subdulcis	7.7
turpis	10.11
Russula amoenolens	7.7 = *r. sororia* s.auct. Brit.
atropurpurea	10.11
cyanoxantha	7.7
foetens	7.7
parazurea	7.7

'APHYLLOPHORALES' (Bracket fungi etc.)

Abortiporus biennis	20.10
Athelia arachnoidea	DLH+
Auriculariopsis ampla	18.8 PCH det. AH. *Populus* twigs K
Bjerkandera adusta	1963+
fumosa	9.9 *sorbus* × *latifolia* stump
Botryobasidium aureum	DLH *Haplotrichum* anamorph state only, IMI
Brevicellicium olivascens	6.10
Byssomerulius corium	PCH+
Ceriporia viridans	28.11
Ceriporiopsis gilvescens	PCH det. P. J. Roberts K
Chondrostereum purpureum	1963+ as *Stereum* p., eg on *Salix* stump
Clavaria acuta	24.11 K
argillacea	28.11 K
Clavulina cristata	PCH+ 18.8
Clavulinopsis helvola	27.10
laeticolor	6.10 = *c. pulchra* K
Coniophora puteana	1963+ in 1963 as 'forma laxa')not worth sep.)
Cristinia coprophila	221.7 3rd Brit. record, on chipboard K
Crustomyces expallens	28.11 K
Cylindrobasidium evolvens	1963+ as *Corticium* laeve
Daedaleopsis confragosa	PCH+
Gloiothele lactescens	7.7
Ganoderma adspersum	1963+ as *g. applanatum* (not then distinguished)
Henningsomyces candidus	7.7 K
Hyphoderma praetermissum	1963+ as *Gloeocystidium tenue*
puberum	10.11 *Sorbus* × *latifolia* stump K
setigerum	7.7
Hyphodontia sambuci	21.7
Hypochnicium bombycinum	17.11 *Betula* stump
lundellii	20.8 *Populus* roots, 3rd Brit. rec. K
punctulatum	9.9 *Sorbus* × *latifolia* stump
Lentinus lepideus	27.8 from sleepers edging a bed K
Meripilus giganteus	PCH+
Merismodes fasciculatus	24.11 fallen *Salix* twig K
Peniophora cinerea	21.7
lycii	27.8 e.g. *Populus* twigs
Perenniporia fraxinea	21.7 on base of *Platanus* K
Phanerochaete magnoliae	4.8 = *Peniophora eichleriana,* on chipboard K
Phellinus ferruginosus	20.8 cherry K
Phlebia livida	28.11 K
Phlebia radiata	1963 as *Ph. merismoides*
Polyporus squamosus	PCM
Radulomyces confluens	1963+ as *Corticium* c.
Ramaria abietina	20.10 K
stricta	9.9 massive specimens on mulched soil K
sp.?	17.11 untraced, spores small and smooth

Schizopora paradoxa	10.11
Sistotrema brinkmannii	1963+ as *Trechispora b.*
oblongispora	15.8 *Quercus* twig K
Skeletocutis nivea	PCH det. AH
Stereum hirsutum	1963+
rameale	7.7 K
rugosum	6.10
Tomentella ellisii	15.8 K
punicea	21.7 K
sublilacina	28.11
Tomentellastrum cf. *caesiocinereum*	9.9 small fragment on soil
Trametes gibbosa	PCH+ as *Pseudotrametes g.*
versicolor	1963+ as *Coriolus v.*
Trechispora cf. *dimitica*	2010 litter near remains of elm stump K

'HETEROBASIDIOMYCETES' (jelly fungi)

Auricularia auricula-judae	BI+
mesenterica	PCH+
Dacrymyces stillatus	1963+ as *D. deliquescens*
Helicogloea lagerheimii	17.11 *Salix* stump det. P. J. Roberts K
Myxarium nucleatum	10.11

'GASTEROMYCETES' (Puffballs etc.)

Bovista plumbea	9.9
Calvatia gigantea	1963+
Cyarhus olla	DLH+ on mulched beds, IMI
Handkea excipuliformis	PCH = *Calvatia e.*
Lycoperdon perlatum	7.7
pyriforme	1963+
Scleroderma bovista	PCH+
Sphaerobolus stellatus	7.7
Vascellum pratense	20.10

UREDINALES (Rusts)

Malampsora cf. *epitea*	6.10 on *Salix* sp. seedling
euphorbiae	PCH+ on *E. peplus*
hypericorum	PCH+ on *Hypericum* sp.
larici-populina	6.10 on *Populus* cf. *balsamifera*
Phragmidium bulvosum	6.10 on *Rubus* sp. det. PCH
cf. *mucronatum*	20.8 on *Rosa gallica* (uredospores only)
violaceum	6.10 on *Rubus* sp.
Puccinia caricina	21.7 *v. ribesii-pendulae* on *Carex pendula*
Puccinia caricina	PCH *v. urticae-acutiformis* on *c. acutiformis*?
cnici	PCH+ on *Cirsium vulgare*
coronata v. holci	PCH
iridis	27.10 on *Iris foetidissima* K
lagenophorae	PCH+ on *Senecio vulgaris, Bellis perennis*
lapsanae	PCH+
malvacearum	PCH+
polygoni-amphibii	PCH
var. *convolvuli*	19.9 on *Fallopia convolvulus* K
pulverulenta	27.8 on *Epilobium montanum*
punctiformis	PCH on *Cirsium arvense*
Pucciiastrum epilobii	9.9 pn *Chamerion angustifolium*
Uromyces muscari	PCH originally as *U. scillarum*

USTILAGINALES (Smuts)

Tilletia holci	PCH+ on *Holcus mollis*
Ustilago striiformis	PCH on *Holcus mollis*

ASCOMYCOTA (Rusts)

Species found only in their anamorph state are here placed in [ ]. Details of these are listed under 2.5 below 'Imperfect Forms'.

DISCOMYCETES

Aleuria aurantia	PCH as *Peziza* a.
Ascobolus crenulatus	PCH corrected from *A. minutus*
roseopurpurascens	6.10 horse dung kept damp
Dactylospora sp.?	PCH 3.1.95 awaiting verdict from IMI
[*Diplocarpon rosae*]	as *Marssonina anamorph*
Geopora foliacea	PCH det. B. M. Spooner
Hamatocanthoscypha laricionis	28.11 fallen *Taxus* leaves K
Hymenoscyphus caudatus	17.11 *Ailanthus petioles*
herbarum	10.11 dead stems of *Origanum* sp.
Iodophanus carneus	PCH+
Mitrophora semilibera	1963 described as '*gigas* from'
Mollisia cinerea s.l.	PCH+
discolor	15.8 *Quercus* twig (= v. *longispora* s.auct.)
[*Monilinia fructigena*]	as *Monilia* anamorph
Orbilia delicatula	PCH = *O. xanthostigma* of 1985 checklist
inflatula	4.8 = *O. auricolor sensu* 1985 checklist
Peziza vesiculosa	15.8 conf. B. M. Spooner K
[*Phacidium multivalve*]	as *Phacidiostroma* anamorph
Polydesmia pruinosa	PCH
Rhytisma acerinum	27.10 *Acer pesudoplatanus* seedling
Sccobolus depauperatus	6.10 horse dung kept damp
Scutellinia subhirtella	6.10 soil by lake, det S. Lines
Trochila ilicina	DLH *Ilex* leaves, fallen
Verpa conica	1963

'PYRENOMYCETES'

[*Apiocrea chrysosperma*]	as *Sepedonium* anamorph
Apiognomonia errabunda	BI *Quercus* fallen leaves
veneta	as *A. errabunda,* now considered a distinct species. *Plantanus* fallen leaves
[*Apiospora montagnii*]	as *Arthrinium* anamorph
[*Botryosphaeria stevensii*]	as *Diplodia mutila* anamorph
Capronia parasitica	15.8 old stromata of *Diatrypella quercina* K
Cephalotheca sulfurea	6.10 PCH det. AH, old worked wood, rare, IMI, K
Ceratostomella rostrata	28.11 = *C. ampullasca, Sorbus* stump K
Cercophora caudata	17.11 indet, stump K
Coniochaeta velutina	17.11 *Salix* stump K
Cryptodiaporthe salicella	DLH
[*Daldinia concentrica*]	as *Nodulisporium* anamorph
Diaporthe pardalota	9.9 Chusan palm leaf stalk det. B. M. Spooner K
Diatrypella favacea	24.11 twig of *Betula papyrifera*
quercina	DLH+ IMI; plus its *Libertella* state (AH)

Didymella proximella	21.7 *Carex pendula* leaf K
sp.	20.8 Heracleum sp. stem K (unnamed at Kew)
Epichloe typhina	PCH *Dactylis glomerata*
Eutypa leioplaca	DLH dead *Fagus* branch IMI
Gibberella sp.	17.11 *Ailanthus petiole* (old, no longer fertile)
Hypomyces aurantius	21.7 + *Cladobotryyum* anamorph
Hypoxylon rubiginosum	17.11 *Salix* stump
Kernia nitida	6.10 horse dung kept damp, rare, K
Lasiosphaeria caudata	15.8 *Quercus* twig
ovina	4.8 *Platanus* stump
spermoides	PCH
Leptosphaeria purpurea	4.8 chipboard K
Leptospora rubella	4.8 chipboard
Lophiostoma angustilabrum	19.9 dead root, ?*Ulmus* K
Nectria aquifolii	1963 det. C. Booth
cinnabarina	1963+
Nemania serpens	28.11 = *Hypoxylon* s., *Sorbus* stump
Ophiostoma novi-ulmi	DLH Dutch Elm disease, symptoms noted
Pleospora infectoria	4.8 dead leaf stem of Chusan palm
Podaspora decipiens	6.10 horse dung kept damp
Preussia funiculata	21.7 chipboard K
Phaeosphaeria herpotrichioides	21.7 *Carex pendula* leaf
Schizothecium fimicola	6.10 = *S. conicum,* horse dung kept damp
Stomiopeltis juniperi	15.8 dead leaves of *Juniperus* sp.
Trichothyrina norfolciana	21.7 cf. this (immature) on *Carex pendula* leaf
Tubeufia cerea	4.8 fallen twig (*Ilex*?)
[*Valsa nivea*]	as *Cytospora* anamorph
Xylaria carpophila	15.8 old *Fagus* cupules
hypoxylon	PCH+
polymorpha	1963, PCH
Zopffiella erostrata	6.10 horse dung kept damp

ERYSIPHALES (Powdery mildew)

(a * against a host denotes ascocarps seen on that host)
(a ! denotes a suspected first British record on this host)

Blumeria graminis	15.8 *Dactylis glomerata*
Erysiphe artemisiae	9.9 *A. vulgaris*
aquilegiae v. ranunculi	15.8 *Ranunc. acris**, *Cimicifuga rubrifolia**! K
biocellata	PCH+ *Lycopus europaeus*
cichoracearum	PCH+ *Achillea cultivar, Bellis perennis, Cirsium vulgare**, *Dahlia* 'Bishop of Llandaff', *Hieracium trichocaulson, Sonchus arvensis, S. oleraceus**
v. fischeri	20.8 *Senecio vulgaris*
convolvuli	9.9 *Calystegia sepium**
cruciferarum	21.7 *Lunaria rediviva, Sisymbrium officinale*
echinopsis	20.8 *Echinops ritro* 'alba'
galeopsidis	15.8 *Lamium album, L. purpureum, Monarda cultivar, M. sagittarius*
galii	6.10 *Galium odoratum* (planted)
heraclei	PCH+ e.g. *Aethusa cynapium, Heracleum* sp.*! (the unnamed 'palace' hogweed), *Cheirophyllum aureum**! K
knautiae	20.8 *Knautia cultivar, K. macedonica*
magnicellulata	27.8 *Phlox cultivars*
orontii	6.10 *Acanthus spinosus**! K
pisi	20.8 *Medicago lupulina, Vicia cracca*

polygoni	4.8 *Persicaria maculosa, Polygonum aviculare**. *Rumex acetosella*
sordida	4.8 *Plantago major*
urticae	15.8 *U. dioica*
Microsphaera alphitoides	PCH+ *Quercus*
berberidos	7.7 *Mahonia aquifolium, Berberis* sp.
euonymi-japonici	BI *E. japonicus*
lonicerae	19.9 *L. inflexa* in a pot
penicillata	24.11 *Alnus* sp.* K
platani	BI *Platanus* × *hispanica**
pseudacaciae	15.8 *Robiinia* sucker shoots K
syringae	9.9 *Syringa hyacinthiflora* culitvars
trifolii	20.8 *Lotus corniculatus, Trifolium pratense*
Oidium ericinum	20.8 *Rhododendron* (Azalea) cultivars
Podosphaera clandestina	15.8 *Crataegus* seedlings
Sawadaia bicornis	20.8 = *Uncinula* b., *Acer* pseud. seedlings
Sphaerotheca epilobii	27.8 *E. montanum*
euphorbiae	20.8 *E. amygdaloides 'rubra'*
fungax	20.8 Geranium cultivar 'Mrs Clark', *G. dissectum, G. molle*
fuliginea	27.8 *Veronica longifolia* cultivar
fusca	15.8 *Lapsana communis, Taraxacum officinale* sl.
pannosa	20.8 *Rosa* spp.
Uncinula adunca	20.8 *Populus canescens**
necator	19.9 *Vitis* sp.*

IMPERFECT FORMS (Coelomycetes and Hyphomycetes)

In general species with a known perfect state are listed here rather than under that state when only the conidial state has been recorded in the garden. But an exception is made for Powdery Mildews, which are all listed at 2.3 above, whether there were ascocarps present or not.

Alternaria alternata	15.8 *Alnus incana* 'cone'
infectoria	DLH *Onopordon* stems with *Iodophanus carneus* (coll. PCH, Det. IMI)
tenuissima	DLH dead *Heracleum* stems
Ampelomyces quisqualis	20.8 on mildew *Erysiphe knautiae* K (and on many other mildew species since)
Arthrinium state of *Apiospora montagnei*	DLH dead grass stem
Arthrobotrys oligosporum	6.10 horse dung kept damp
Bactrodesmium obovatum	19.9 dead exposed *Ulmus*? root K
Beauveria bassiana	4.8 *Opiliones* (harvestmen) K
Botrytis cinerea	1963+ various hosts
tulipae	1963 Tulip Fire Fungus
Camposporium antennatum	15.8 *Fagus* cupules K
pellucidum	15.8 *Fagus* cupules
Ceuthospora euonymi	1963
phacidioides	BI+ *Ilex* leaves = imperf. state of *Phacidium multivalve*
Chalara cylindrosperma	17.11 *Ailanthus petiole* K
Cladosporium herbarum	DLH e.g. fallen *Platanus* leaves IMI
Clonostachys compactiuscula	28.11 *Fagus* cupules
Colletotrichum dematium	DLH dead *Heracleum* stems
Costantinella micheneri	24.11 soil near *Prunus* K
terrestris	10.11 *Ulmus*, rotten wood K
Cytospora nivea state of *Valsa (Leucostoma) nivea*	208 bark of fallen *Populus* twigs K

Cytospora salicis	27.8 fallen *Salix* twigs K
Dactylaria purpurella	4.8 *Platanus* stump
Dendryphion comosum	24.11 *Urtica* stem
Dictyochaeta fertilis	15.8 = *Codinaea* f., *Fagus* cupules
simplex	15.8 = *Codinaea* s., *Fagus* cupules
Dictyosporium toruloides	15.8 *Fagus* cupules
Dinemasporium cf. *cytosporoides*	15.8 *Quercus* twigs K
graminum	4.8 dead stem of Chusan palm leaf K
Diplodia mutila state of *Botryosphaeria stevensii*	DLH *Fraxinus* twigs
Discosia artocreas	15.8 *Alnus incana* cones, *Quercus* cupules (both after keeping damp)
Doratomyces nanus	1963 det. M. B. Ellis
stemonitis	28.11 *Fagus* cupules
Endophragmiella taxi	28.11 fallen leaves of *Taxus baccata*
Fusariella hughesii	9.9 dead *umbellifer* stem + *Ailanthus petiole*
Fusidium aeruginosum	10.11 *Quercus* leaves
Helicosporium lumbricoides	15.8 Fagus cupule kept damp
[*Libertella quercina*]	15.8 state of *Diatrypella quercina* q.v.
Macrophoma ulmi	1963 det. B. C. Sutton, then new to Britain
Marssonia state of *Diplocarpon rosae*	DLH leaves of *Rosa* 'Freedom'
Menispora ciliata	28.11 *Sorbus* stump
Monilia fructigena state of *Monilinia* f.	20.8 rotten fallen apples
Monodictys castaneae	DLH fallen *Tilia* leaf
Nodulisporium sp.	PCH anamorph of *Daldinia concentrica*
Oedocephalum pallidum	6.10 horse dung kept damp
Paecilomyces farinosus	PCH as *Isaria* f.
Periconia byssoides	DLH *Urtica* stems
minutissima	15.8 *Fagus* cupule kept damp
Phoma complanata	27.8 *Anthriscus sylvestris*?, dead stem
herbarum	DLH *Urtica* stems
Phomopsis controversa	DLH *Fraxinus* twig
oblonga	1963 det. B. C. Sutton
Pithomyces chartarum	24.11 *Urtica* stem, uncommon in Britain, K
Pleurotheciopsis bramleyi	15.8 *Alnus incana* cone kept damp K
Pseudozythia pusilla	1963 det. B. C. Sutton, then new to Britain
Pycnostysanus azaleae	15.8 'bud blast' on *Rhododendron* spp.
Sepedoniu, chrysospermum state of *Apiocrea chrys.*	PCH+ *Paxillus involv., Xerocomus chrysenteron*
Sphaeronema cf. *aemulans*	15.8 *Quercus* cupules kept damp K (det. E. Pumithalingam)
Stachybotrys atra	PCH+ chipboard, det. A.H.
Torula herbarum	DLH, PCH+ e.g. *Urtica* stems
Trichocladium opacum	1963 det. M. B. Ellis
Trichoderma viride	1963+
Trichothecium roseum	9.9 indet. rotting woody herbaceous stem
Tricladium castaneicola	27.8 *Fagus* cupules kept damp
Trimmatostroma betulinum	DLH dead *Salix* twigs
Triposporium elegans	DLH *Sorbus* stump
Verticillium rexianum	17.11 on myxomycete *Arcyria denudata*
Volutella ciliata	28.11 *Fagus* cupules

ZYGOMYCOTA

Rhopalomyces elegans	PCH
Syzygites megalocarpa	20.10 on old *Calvatia gigantea* fr. body K

OOMYCOTA (Kingdom Chromista p.p.)

Albugo candida	PCH 'White Blsiter' of Cruciferae
Albugo tragopogonis	BI on *Senecio vulgaris*

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Initial discussions between Buckingham Palace, the London Natural History Society and The Natural History Museum identified the need for some form of coordinating body to oversee the project. Accordingly, a steering group of "Core Recorders" was established. Meeting on a regular, though relatively infrequent basis within the Palace, this group was responsible for ensuring that the taxonomic coverage of the survey was as complete as possible and for finding appropriate personnel to undertake the field surveys, the identification of material and the writing up of results. This Core Recorders committee comprised Peter Barnard, Colin Bowlt (Chair), David Carter, David Hawksworth, Alick Henrici, Peter Holland, Mark Lane (Buckingham Palace), David McClintock, Edward Milner, myself, Roy Sanderson, Mary Spencer-Jones and Elinor Wiltshire. LNHS Secretary Tony Barrett and Quekett Microscopical Club representative Bryan Tabor both attended by invitation.

The authors of the papers are clear from the first page of each; their important contributions are acknowledged, though there is little point in repeating their names here. What are not so clear are the names of the other naturalists who also played a significant role, either in fieldwork at the Garden or as identifiers of material. Francis Rose made a number of comments in relation to the 1960s Bryophyte survey data. Ken Adams, Len Ellis and Alan Harrington assisted with determinations of Bryophytes. Amongst the botanists, Susyn Andrews successfully identified *Syringa* × *hyacinthiflora* 'Plena' (see page 47) whilst David Allen, Jane Browning, John Burnett, Rodney Burton, Lois Childs, John Bailey, Eric Clement, Tom Cope, Andrew Dudman, Gordon Graham, Ray Harley, Geoffrey Kitchener, Alison Paul, John Richards, Roy Vickery and Max Walters assisted with the higher plants. It is possible that the names of some botanical helpers remain obscure following the death of David McClintock; we hope that these people will forgive the absence of their names under the exceptional circumstances, and rest assured that their contributions are fully appreciated.

Dr Hilary Belcher was responsible for the identification of phytoplankton. Peter Holland was responsible for a great many fungus identifications. Dr F. Rose commented on the list of lichens in the earlier survey; Dr D. Job provided air pollution measurements from the Garden; Dr A. E. Heathfield gave advice of sulphur dioxide measurement conversion rates.

For help with the non-insect invertebrate section, thanks go to Stella M. Davies, who identified the slug *Lehmannia valentiana*, to Peter Merrett, David Nellist and Peter Harvey, who assisted with spider determinations, to Cliff Brooks, who assisted in the earthworm survey, Professor Roberto Bertolani, who confirmed the identification of some tardigrades, to Dr Geoffrey Fryer, who contributed comments and advice on the anomopodan Crustacea and to Peter Lawrence, Eric Goto, Henning Petersen, Arne Fjellberg and Steve Hopkin, all of whom contributed advice on the taxonomy of the Collembola.

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On the Buckingham Palace side, Mark Lane, Head Gardener, sought and obtained enthusiastic permission for the survey from Her Majesty The Queen and has played a pivotal role in the day-to-day organisation of the survey. In particular, he managed irregular visits of field naturalists, all of whom required security clearance and most of whom required an escort whilst at the Palace. It is fair to say that without Mark's input very little would have been achieved and I am personally delighted that a species of insect new to science, discovered in the Garden during the survey, has been named in his honour (*Megaselia marklanei*, see pages 254–255). Other garden staff also deserve a mention for their interest and cooperation.

Mention should also be made of the officers of the Metropolitan Police, based at the Palace — always friendly and courteous, whilst still rigorously carrying out their important security duties. Finally, as far as Palace staff are concerned, it is also appropriate to mention Sir Michael Peat (Keeper of the Privy Purse), David Tuck (former Assistant Press Secretary) and Penny Russel-Smith (the current Press Secretary), all of whom had some input to this final report.

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Colin W. Plant
December 2001

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